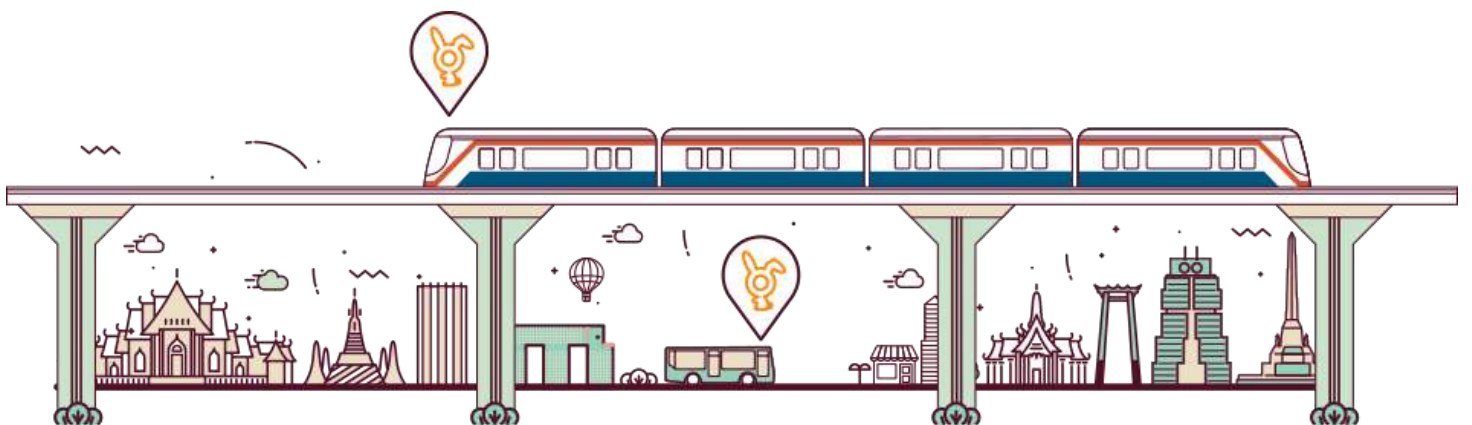


# ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ



## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P801	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2728	22 Jul 22	21 Jul 23	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1585	27 Jul 22	26 Jul 23	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Fisher Scientific	42C 0517512000	UAE Consultant Co., Ltd.	07042022	7 Apr 22	6 Apr 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 0517512001	UAE Consultant Co., Ltd.	07042022	7 Apr 22	6 Apr 23	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co., Ltd.	24062560	24 Jun 22	23 Jun 23	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co., Ltd.	29062022	29 Jun 22	28 Jun 23	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778109	UAE Consultant Co., Ltd.	29062022	29 Jun 22	28 Jun 23	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778110	UAE Consultant Co., Ltd.	10102022	10 Oct 22	9 Oct 23	-
11	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636462	UAE Consultant Co., Ltd.	02052022	2 May 22	1 May 23	-
12	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050151	UAE Consultant Co., Ltd.	24062022	24 Jun 22	23 Jun 23	-
13	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PS/G	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140003	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co.,Ltd.	29042022	29 Apr 22	28 Apr 23	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497730	UAE Consultant Co.,Ltd.	17062022	17 Jun 22	16 Jun 23	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497732	UAE Consultant Co.,Ltd.	12092022	12 Sep 22	11 Sep 23	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497733	UAE Consultant Co.,Ltd.	12092022	12 Sep 22	11 Sep 23	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	06102022	6 Oct 22	5 Oct 23	-
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778118	UAE Consultant Co.,Ltd.	06102022	6 Oct 22	5 Oct 23	-
21	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778119	UAE Consultant Co.,Ltd.	15062022	14 Jun 22	13 Jun 23	-
22	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
23	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 VUPVC21	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
24	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 PDXEGXF7	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
25	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 SSGEYBJ	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
26	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 VV2FY3R3	UAE Consultant Co.,Ltd.	21032022	21 Mar 22	20 Mar 23	-

## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
27	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 T4FG19AN	UAE Consultant Co.,Ltd.	04042022	4 Apr 22	3 Apr 23	-
28	Total Hydrocarbons Analyzer	Non Methane-Hydrocarbon	HORIBA	APHA-370 HAMEHU5M	UAE Consultant Co.,Ltd.	21032022	21 Mar 22	20 Mar 23	-
29	Standard Gas	Non Methane-Hydrocarbon	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
30	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0008	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
31	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
32	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0106	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
33	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
34	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
35	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0116	Scarlet Tech Ltd.	14092022	14 Sep 22	13 Sep 23	-
36	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 19040405	Thai Meteorological Department	148/22	7 Apr 22	6 Apr 23	-
37	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 20020300	Thai Meteorological Department	149/22	7 Apr 22	6 Apr 23	-
38	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35 44783	Innovative Instrument Co.,Ltd.	22-ACT-524	19 Aug 22	18 Aug 23	-
39	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hr}$ $L_{A90}$ $L_{A50}$	Larson Davis	LXT2 0006614	Innovative Instrument Co.,Ltd.	22-ACT-104	11 Feb 22	10 Feb 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
40	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0006615	Innovative Instrument Co.,Ltd.	22-ACT-102	11 Feb 22	10 Feb 23	-
41	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0006616	Innovative Instrument Co.,Ltd.	22-ACT-113	15 Feb 22	14 Feb 23	-
42	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0006617	Innovative Instrument Co.,Ltd.	22-ACT-100	11 Feb 22	10 Feb 23	-
43	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	24 Jan 23	-
44	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	25 May 22	24 May 23	-
45	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005304	Innovative Instrument Co.,Ltd.	22-ACT-249	1 Apr 22	31 Mar 23	-
46	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005407	Innovative Instrument Co.,Ltd.	22-ACT-037	21 Jan 22	20 Jan 23	-
47	Sound Level Meter	$L_{Aeq} 1 hr$ , $L_{Aeq} 24 hrs$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005344	Innovative Instrument Co.,Ltd.	22-ACT-248	1 Apr 22	31 Mar 23	-

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Mode/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองขนาดไม่เกิน 10 ไมครอน (PM10) ฝุ่นละอองรวม (TSP)	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722-ACC-TH	7 Apr 22	6 Apr 23	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	TH2058-098-040722-ACC-TH	7 Apr 22	6 Apr 23	-
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ									
3	pH Meter	pH Temperature	Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2202095-001-01	16 Mar 22	15 Mar 23	-
4	pH Meter		Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2203527-001-01	5 Jul 22	4 Jul 23	-
5	Analytical Balance (Readability 0.01 mg)	TDS, SS	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	22MM4210	26 Apr 22	25 Apr 23	-
6	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
7	Analytical Balance (Readability 0.1 mg)	Oil & Grease	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2202934-001-01	13 May 22	12 May 23	-
8	BOD Incubator		Arco	UC4-1320 / (UAE,WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
9	Incubator	TCB	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	7 Apr 22	6 Apr 23	-
10	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	22TM565	7 Apr 22	6 Apr 23	-
11	Analytical Balance	TCB	Mettler-Toledo	MS6035 / B007010311	Mettler-Toledo (Thailand) Ltd.	TH2058-096-040722-ACC-TH	7 Apr 22	6 Apr 23	-
12	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.

RECALIBRATION  
DUE DATE:  
**July 5, 2023**

## Certificate of Calibration

Calibration Certification Information				
Cal. Date:	July 5, 2022	Rootmeter S/N:	4383320	Ta: 297 °K
Operator:	Jim Tisch	Pa:	750.1	mm Hg
Calibration Model #:	G25A	Calibrator S/N:	1901	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation				
Vstd (m3)	Qstd (k-axes)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \sqrt{\frac{Tstd}{Ta}} \right)}$ (y-axis)	Va (k-axes)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.9956	0.7353
0.9818	1.0174	1.9902	0.9915	1.0274
0.9797	1.1339	2.2251	0.9893	1.1451
0.9785	1.1933	2.3337	0.9881	1.2050
0.9732	1.4354	2.8146	0.9828	1.4496
m= 1.98897			m= 1.24546	
b= -0.03691			b= -0.02334	
r= 0.99996			r= 0.99996	

Calculations				
Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$	
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime	
For subsequent flow rate calculations:				
Qstd=	$1/m \left( \left( \frac{\Delta H}{Pa} \sqrt{\frac{Tstd}{Ta}} \right) b \right)$	Qa=	$1/m \left( \left( \frac{\Delta H}{Ta/Pa} \right) b \right)$	

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.  
145 South Miami Avenue  
Village of Cleves, OH 45002

www.tisch-env.com  
TOLL FREE: (877)263-7610  
Tel: (513)777-9009

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### Certificate of Calibration


Customer	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Certificate No : 22-ACT-104
Name	81 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	Request No : Req-2022-0232


Unit Under Calibration Details	
Measurement Item :	Sound Level Meter
Manufacturer :	LARSON DAVIS
Model :	LxT2
Serial Number :	0066614
ID :	UAE.EFM.045/2564
Resolution :	0.1 dB
Instrument Status :	Used

Calibration Environment and Details	
Temperature :	23 °C ± 2 °C
Humidity :	50 %RH ± 20 %RH
Barometric Pressure :	1013 kPa ± 10 kPa
Received Date :	31 January 2022
Calibrated Date :	11 February 2022
Calibration Procedure :	In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration :	Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	182275	13 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svanick	Svan401	131	18 October 2022	WK Electric

Note:  
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %

Calibrated By :   
Mr. Noppadon Luangum  
Calibration Officer

Approved By :   
Mr. Pasi Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
PMA-709-01.34-01 Rev.0 Issue Date: 01/07/19

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Certificate No : 22-ACT-104  
Request No : Req-2022-0232

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	Acceptance
FAST / A / 37-139	Level	UUC (dB)	ERR (dB)	UNCERTAINTY (± dB)
Calibrator Setting	(dB)	(dB)	(dB)	Limit (± dB)
1000 Hz 114.00 dB	113.85	114.0	+0.13	0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN:58079

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.7	0.10

#### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.6	0.10
C	28.8	0.10
Z	34.7	0.10

#### 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(± dB)	Limit (± dB)
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.7	0.7	0.7	0.60	3.0
8000 Hz	1.0	0.9	0.8	0.70	5.0

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Certificate No : 22-ACT-104  
Request No : Req-2022-0232

#### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(± dB)	Limit (± dB)
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0	0.2	1.5
250 Hz	-0.1	0.0	0.0	0.2	1.5
500 Hz	-0.1	0.0	0.0	0.2	1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.1	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	0.0	0.0	0.0	0.2	5.0
16000 Hz	-0.1	-0.1	-0.1	0.2	+5, -INF

#### 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC (dB)	ERR (dB)	Limit (± dB)
UUC Weighting	(dB)	(dB)	(dB)	(± dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC (dB)	ERR (dB)	Limit (± dB)
UUC Time Response	(dB)	(dB)	(dB)	(± dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Log	114.00	114.0	0.0	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
PMA-709-01.34-01 Rev.0 Issue Date: 01/07/19

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Certificate No : 22-ACT-104  
Request No : Req-2022-0232

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

#### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
140.00	140	140.0	0.0	1.1
139.00	139	139.0	0.0	1.1
138.00	138	138.0	0.0	1.1
137.00	137	137.0	0.0	1.1
136.00	136	136.0	0.0	1.1
135.00	135	135.0	0.0	1.1
134.00	134	134.0	0.0	1.1
133.00	133	133.0	0.0	1.1
132.00	132	132.0	0.0	1.1
131.00	131	131.0	0.0	1.1
130.00	130	130.0	0.0	1.1
129.00	129	129.0	0.0	1.1
128.00	128	128.0	0.0	1.1
127.00	127	127.0	0.0	1.1
126.00	126	126.0	0.0	1.1
125.00	125	125.0	0.0	1.1
124.00	124	124.0	0.0	1.1
123.00	123	123.0	0.0	1.1
122.00	122	122.0	0.0	1.1
121.00	121	121.0	0.0	1.1
120.00	120	120.0	0.0	1.1
119.00	119	119.0	0.0	1.1
118.00	118	118.0	0.0	1.1
117.00	117	117.0	0.0	1.1
116.00	116	116.0	0.0	1.1
115.00	115	115.0	0.0	1.1
114.00	114	114.0	0.0	1.1
113.00	113	113.0	0.0	1.1
112.00	112	112.0	0.0	1.1
111.00	111	111.0	0.0	1.1
110.00	110	110.0	0.0	1.1
109.00	109	109.0	0.0	1.1
108.00	108	108.0	0.0	1.1
107.00	107	107.0	0.0	1.1
106.00	106	106.0	0.0	1.1
105.00	105	105.0	0.0	1.1
104.00	104	104.0	0.0	1.1
103.00	103	103.0	0.0	1.1
102.00	102	102.0	0.0	1.1
101.00	101	101.0	0.0	1.1
100.00	100	100.0	0.0	1.1
99.00	99	99.0	0.0	1.1
98.00	98	98.0	0.0	1.1
97.00	97	97.0	0.0	1.1
96.00	96	96.0	0.0	1.1
95.00	95	95.0	0.0	1.1
94.00	94	94.0	0.0	1.1
93.00	93	93.0	0.0	1.1
92.00	92	92.0	0.0	1.1
91.00	91	91.0	0.0	1.1
90.00	90	90.0	0.0	1.1
89.00	89	89.0	0.0	1.1
88.00	88	88.0	0.0	1.1
87.00	87	87.0	0.0	1.1
86.00	86	86.0	0.0	1.1
85.00	85	85.0	0.0	1.1
84.00	84	84.0	0.0	1.1
83.00	83	83.0	0.0	1.1
82.00	82	82.0	0.0	1.1
81.00	81	81.0	0.0	1.1
80.00	80	80.0	0.0	1.1
79.00	79	79.0	0.0	1.1
78.00	78	78.0	0.0	1.1
77.00	77	77.0	0.0	1.1
76.00	76	76.0	0.0	1.1
75.00	75	75.0	0.0	1.1
74.00	74	74.0	0.0	1.1
73.00	73	73.0	0.0	1.1
72.00	72	72.0	0.0	1.1
71.00	71	71.0	0.0	1.1
70.00	70	70.0	0.0	1.1
69.00	69	69.0	0.0	1.1
68.00	68	68.0	0.0	1.1
67.00	67	67.0	0.0	1.1
66.00	66	66.0	0.0	1.1
65.00	65	65.0	0.0	1.1
64.00	64	64.0	0.0	1.1
63.00	63	63.0	0.0	1.1
62.00	62	62.0	0.0	1.1
61.00	61	61.0	0.0	1.1
60.00	60	60.0	0.0	1.1
59.00	59	59.0	0.0	1.1
58.00	58	58.0	0.0	1.1
57.00	57	57.0	0.0	1.1
56.00	56	56.0	0.0	1.1
55.00	55	55.0	0.0	1.1
54.00	54	54.0	0.0	1.1
53.00	53	53.0	0.0	1.1
52.00	52	52.0	0.0	1.1
51.00	51	51.0	0.0	1.1
50.00	50	50.0	0.0	1.1
49.00	49	49.0	0.0	1.1
48.00	48	48.0	0.0	1.1
47.00	47	47.0	0.0	1.1
46.00	46	46.0	0.0	1.1
45.00	45	45.0	0.0	1.1
44.00	44	44.0	0.0	1.1
43.00	43	43.0	0.0	1.1
42.00	42	42.0	0.0	1.1
41.00	41	41.0	0.0	1.1
40.00	40	40.0	0.0	1.1
39.00	39	39.0	0.0	1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104  
Request No : Req-2022-0232

#### 9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	44.1	43.7	-0.4	1.1
	114	114.0	0.0	1.1

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1.0
	2	118.0	117.9	-0.1	+1.0,-2.5
	0.25	109.0	108.7	-0.3	+1.5,-5.0
Slow	200	128.6	128.5	-0.1	1.0
	2	109.0	108.8	-0.2	+1.0,-5.0
SEL	200	129.0	129.0	0.0	1.0
	2	109.0	109.1	+0.1	+1.0,-2.5
	0.25	100.0	99.7	-0.3	+1.5,-5.0

#### 11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.7	-0.70	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104  
Request No : Req-2022-0232

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.7		
Negative one-half cycle	142.6		
Deviated	0.1	0.2	1.3

#### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม

#### Certificate of Calibration

##### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-102  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0233  
10260

##### Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LxT2 Microphone S/N : 325672  
Serial Number : 0006615 Preamplifier Model : PRMLxT2C  
ID : UAE.EFM.046/2564 Preamplifier S/N : 071539  
Resolution : 0.1 dB Instrument Status : Used

##### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2022  
Calibrated Date : 11 February 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


##### Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svante	Svan601	131	18 October 2022	WK Electric

##### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Mr. Noppidon Laangrit  
Calibration Officer

Approved By :   
Mr. Pacht Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม



Certificate No : 22-ACT-102  
Request No : Req-2022-0233

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1600 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	27.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	27.7	0.10
C	27.5	0.10
Z	34.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
	A	C	Z	(± dB)	(± dB)
FAST / 37-139	(dB)	(dB)	(dB)		
STD Setting					
125 Hz	-0.1	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.5	0.5	0.6	0.60	3.0
8000 Hz	0.3	0.3	0.4	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

JM-708-SLM-01 Rev.0 Issue date: 01/07/01

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102  
Request No : Req-2022-0233

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting					
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Log	114.00	114.0	0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

JM-708-SLM-01 Rev.0 Issue date: 01/07/01

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102  
Request No : Req-2022-0233

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0	0.1	0.3
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
140.00	140	140.0	0.0	0.3	1.1
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1	0.3	1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	68.9	-0.1		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	58.9	-0.1		1.1
54.00	54	53.9	-0.1		1.1
49.00	49	48.9	-0.1		1.1
44.00	44	44.0	0.0	0.2	1.1
39.00	39	39.2	0.2		1.1
34.00	34	34.3	0.3		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

JM-708-SLM-01 Rev.0 Issue date: 01/07/01

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102  
Request No : Req-2022-0233

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	43.2	42.9	-0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.6	-0.4		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	109.0	0.0		+1.0, -2.5
	0.25	100.0	99.8	-0.2		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

JM-708-SLM-01 Rev.0 Issue date: 01/07/01

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102  
Request No : Req-2022-0233

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.7		
Negative one-half cycle	141.7		
Deviated	0.0	0.2	1.5

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-708-CEM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 22-ACT-113  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phakong, Bangkok, Request No : Req-2022-0730  
10260

### Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LA72 Microphone S/N : 329551  
Serial Number : 9006616 Pre-amplifier Model : PRMLaTDC  
ID : UAEJFM.0472584 Pre-amplifier S/N : 073798  
Resolution : 0.1 dB Instrument Status : Used

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 14 February 2022  
Calibrated Date : 15 February 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration : Lab Acoustic


### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	IFA000234	14 June 2022	TSI
Audio Generator	Scantek	Scan401	131	18 October 2022	WK Electric

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Mr. Noppadol Luangrit  
Calibration Officer

Approved By :   
Mr. Poch Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 15 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-113  
Request No : Req-2022-0330

## 1. indication at the calibration check frequency

UUC Setting	Nominal	Before adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	114.1	+0.25	113.8	-0.05
				0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN.58079

## 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	26.6	0.10

## 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.4	0.10
C	27.8	0.10
Z	32.4	0.10

## 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve		Limit
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)
125 Hz	0.0 0.1 0.1	0.50	2.0
1600 Hz	0.0 0.0 0.0	0.60	1.0
4000 Hz	0.3 0.3 0.4	0.60	3.0
8000 Hz	-0.1 -0.1 0.0	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-113  
Request No : Req-2022-0330

## 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve		Limit
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)
63 Hz	-0.2 -0.1 -0.1		2.0
125 Hz	-0.1 0.0 -0.1		1.5
250 Hz	-0.1 -0.1 -0.1		1.5
500 Hz	-0.1 0.0 0.0		1.5
1000 Hz	0.0 0.0 0.0	0.2	1.0
2000 Hz	0.0 0.0 0.0		2.0
4000 Hz	0.0 0.0 0.0		3.0
8000 Hz	-0.3 -0.1 0.0		5.0
10000 Hz	-0.1 -0.1 -0.1		>5, <INF

## 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Long	114.00	114.0	0.0	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-113  
Request No : Req-2022-0330

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviation	0.0	0.1	0.3

#### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	93.9	-0.1	1.1
89.00	89	88.9	-0.1	1.1
84.00	84	83.8	-0.1	1.1
79.00	79	78.9	-0.1	1.1
74.00	74	73.9	-0.1	1.1
69.00	69	68.9	-0.1	1.1
64.00	64	63.9	-0.1	1.1
59.00	59	58.9	-0.1	1.1
54.00	54	53.9	-0.1	1.1
49.00	49	49.0	0.0	1.1
44.00	44	44.1	0.1	1.1
39.00	39	39.3	0.3	1.1
34.00	34	34.5	0.5	1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-113  
Request No : Req-2022-0330

#### 9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	43.6	43.7	0.1	1.1
	114	114.0	0.0	1.1

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 27-139	Timeburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1.0
	2	118.0	117.6	-0.4	+1.0, -2.3
	0.25	108.0	108.6	+0.6	+1.5, -5.0
Slow	200	128.6	128.3	-0.1	1.0
	2	109.0	108.8	-0.2	+1.0, -5.0
SEL	200	129.0	129.0	0.0	1.0
	2	109.0	109.0	0.0	+1.0, -2.3
	0.25	109.0	99.8	-0.2	+1.5, -5.0

#### 11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.7	-0.70	2.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

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Certificate No : 22-ACT-113  
Request No : Req-2022-0330

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.9		
Negative one-half cycle	141.9		
Deviation	0.9	0.2	1.5

#### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	136.0		
Final	136.0		
Deviation	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
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#### Certificate of Calibration

##### Customer:

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-100  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0234  
10260

##### Unit Under Calibration Details:

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LxT2 Microphone S/N : 328609  
Serial Number : 0006617 Preamplifier Model : PRMLXT2C  
ID : UAE.EFM.048/2564 Preamplifier S/N : 071532  
Resolution : 0.1 dB Instrument Status : Used

##### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2022  
Calibrated Date : 11 February 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

##### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	189273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA0000234	14 June 2022	TSI
Audio Generator	Svanik	Svan401	121	18 October 2022	WK Electric

##### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By : Mr. Neppodon Lumgarn  
Calibration Officer

Approved By : Mr. Pait Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
PIM-708-08-M-01 Rev.0 Issue date 01/07/19  
เอกสารไม่ควบคุม



Certificate No : 22-ACT-100  
Request No : Req-2022-0234

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN:58079

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	28.9	0.10

#### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	28.8	0.10
C	28.4	0.10
Z	34.3	0.10

#### 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.0	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.6	0.6	0.6	0.60	3.0
8000 Hz	0.5	0.5	0.6	0.70	5.0

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FM-708-SLM-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-100  
Request No : Req-2022-0234

#### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit
FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.3
250 Hz	-0.1	0.0	0.0		1.3
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.1	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	0.0	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

#### 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
FAST / 37-139	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-100  
Request No : Req-2022-0234

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0		

#### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
140.00	140	140.0	0.0	0.3	1.1
139.00	139	139.0	0.0		1.1
138.00	138	138.0	0.0		1.1
137.00	137	137.0	0.0		1.1
136.00	136	136.0	0.0		1.1
135.00	135	135.0	0.0		1.1
134.00	134	134.0	0.0		1.1
133.00	133	133.0	0.0		1.1
132.00	132	132.0	0.0		1.1
131.00	131	131.0	0.0		1.1
130.00	130	130.0	0.0		1.1
129.00	129	129.0	0.0		1.1
128.00	128	128.0	0.0		1.1
127.00	127	127.0	0.0		1.1
126.00	126	126.0	0.0		1.1
125.00	125	125.0	0.0		1.1
124.00	124	124.0	0.0		1.1
123.00	123	123.0	0.0		1.1
122.00	122	122.0	0.0		1.1
121.00	121	121.0	0.0		1.1
120.00	120	120.0	0.0		1.1
119.00	119	119.0	0.0		1.1
118.00	118	118.0	0.0		1.1
117.00	117	117.0	0.0		1.1
116.00	116	116.0	0.0		1.1
115.00	115	115.0	0.0		1.1
114.00	114	114.0	0.0		1.1
113.00	113	113.0	0.0		1.1
112.00	112	112.0	0.0		1.1
111.00	111	111.0	0.0		1.1
110.00	110	110.0	0.0		1.1
109.00	109	109.0	0.0		1.1
108.00	108	108.0	0.0		1.1
107.00	107	107.0	0.0		1.1
106.00	106	106.0	0.0		1.1
105.00	105	105.0	0.0		1.1
104.00	104	104.0	0.0		1.1
103.00	103	103.0	0.0		1.1
102.00	102	102.0	0.0		1.1
101.00	101	101.0	0.0		1.1
100.00	100	100.0	0.0		1.1
99.00	99	99.0	0.0		1.1
98.00	98	98.0	0.0		1.1
97.00	97	97.0	0.0		1.1
96.00	96	96.0	0.0		1.1
95.00	95	95.0	0.0		1.1
94.00	94	94.0	0.0		1.1
93.00	93	93.0	0.0		1.1
92.00	92	92.0	0.0		1.1
91.00	91	91.0	0.0		1.1
90.00	90	90.0	0.0		1.1
89.00	89	89.0	0.0		1.1
88.00	88	88.0	0.0		1.1
87.00	87	87.0	0.0		1.1
86.00	86	86.0	0.0		1.1
85.00	85	85.0	0.0		1.1
84.00	84	84.0	0.0		1.1
83.00	83	83.0	0.0		1.1
82.00	82	82.0	0.0		1.1
81.00	81	81.0	0.0		1.1
80.00	80	80.0	0.0		1.1
79.00	79	79.0	0.0		1.1
78.00	78	78.0	0.0		1.1
77.00	77	77.0	0.0		1.1
76.00	76	76.0	0.0		1.1
75.00	75	75.0	0.0		1.1
74.00	74	74.0	0.0		1.1
73.00	73	73.0	0.0		1.1
72.00	72	72.0	0.0		1.1
71.00	71	71.0	0.0		1.1
70.00	70	70.0	0.0		1.1
69.00	69	69.0	0.0		1.1
68.00	68	68.0	0.0		1.1
67.00	67	67.0	0.0		1.1
66.00	66	66.0	0.0		1.1
65.00	65	65.0	0.0		1.1
64.00	64	64.0	0.0		1.1
63.00	63	63.0	0.0		1.1
62.00	62	62.0	0.0		1.1
61.00	61	61.0	0.0		1.1
60.00	60	60.0	0.0		1.1
59.00	59	59.0	0.0		1.1
58.00	58	58.0	0.0		1.1
57.00	57	57.0	0.0		1.1
56.00	56	56.0	0.0		1.1
55.00	55	55.0	0.0		1.1
54.00	54	54.0	0.0		1.1
53.00	53	53.0	0.0		1.1
52.00	52	52.0	0.0		1.1
51.00	51	51.0	0.0		1.1
50.00	50	50.0	0.0		1.1
49.00	49	49.0	0.0		1.1
48.00	48	48.0	0.0		1.1
47.00	47	47.0	0.0		1.1
46.00	46	46.0	0.0		1.1
45.00	45	45.0	0.0		1.1
44.00	44	44.0	0.0		1.1
43.00	43	43.0	0.0		1.1
42.00	42	42.0	0.0		1.1
41.00	41	41.0	0.0		1.1
40.00	40	40.0	0.0		1.1
39.00	39	39.0	0.0		1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-100  
Request No : Req-2022-0234

#### 9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	43.9	43.6	-0.3	0.3	1.1
	114	114.0	0.0		1.1

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR		Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	( ± dB)	( ± dB)
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

Certificate No : 22-ACT-100  
Request No : Req-2022-0234

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#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.8		
Negative one-half cycle	142.7		
Deviated	0.1	0.2	1.5

#### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISO 17025-2:2017 Rev 01 Issue date 01/07/15

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## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sitrinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22081  
Pages : 1 of 8

### Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** LARSON DAVIS  
**Model :** LxT2/ Microphone 375B02 / Preampfier PRML x T2B  
**Serial No.:** 0005286 / 011740 / 056087  
**ID No.:** -

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 18 JANUARY 2022  
**Calibration Date :** 26 JANUARY 2022  
**Date of Issue :** 28 JANUARY 2022

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :** *T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

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## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-02

#### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Digital Multimeter	33511B	MY53202742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	08-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

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*T. Petchurai*

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 3 of 8

#### Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

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*T. Petchurai*



## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.96)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
31.0

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value ( dB )
A - weight	30.8
C - weight	30.6
Flat	36.8

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	0.1	0.0	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	3.1	3.2	3.2	±5.0

QF-TS12-04-04-020664

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T. Reth.

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.1	0.1	± 1.1
132.0	132.1	0.1	± 1.1
131.0	131.1	0.1	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.1	0.1	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.1	0.1	± 1.1
44.0	44.2	0.2	± 1.1
39.0	39.6	0.6	± 1.1

QF-TS12-04-04-020664

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T. Reth.

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0
16000	-0.1	0.0	0.1	±5.0(-∞)

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

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## 8. Level linearity including the level range control

Range	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
140	94.0	94.0	0.0	±0.5

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.2	89.4	0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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T. Retch

451-451/1 Sirinthom Rd., Bangumru, Bangplud Bangkok 10700 THAILAND.  
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Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : LARSON DAVIS  
Model : LxT2/ Microphone 375B02 / Preamplifier PRML x T2B  
Serial No. : 0005289 / 011732 / 056076  
ID No. : -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 18 JANUARY 2022  
Calibration Date : 26 JANUARY 2022  
Date of Issue : 28 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Retch  
( Thanakul Peichurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL22082  
Job No. : VC65AC0044  
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Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Digital Multimeter	33511B	MY53202742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	08-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Continuation of Calibration Certificate

Cert. No. : ACL22082  
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Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.96)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
29.6

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value ( dB )
A - weight	29.4
C - weight	29.1
Flat	34.8

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	0.2	0.2	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	2.6	2.6	2.6	±5.0

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## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	-0.1	0.0	±3.0
8000	0.0	0.1	0.0	±5.0
16000	-0.1	0.1	0.1	±5.0 (-∞)

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

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## 8. Level linearity including the level range control

Range	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
140	94.0	94.0	0.0	±0.5

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.4	0.0	±2.0
Negative half cycle	135.4	135.4	0.0	±2.0

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Certificate No : 22-ACT-249  
Request No : Req-2022-0629

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviant	0.0	0.1	0.3

#### 8. Level linearity on the reference level range

UUC Setting		Anticipated	Deviation		UNCERTAINTY  (± dB)	Acceptance
FAST / A / 37-139		REF	UUC	ERR		Limit
STD dB		(dB)	(dB)	(dB)		(± dB)
130.00		130	130.0	0.0	0.3	1.1
134.00		134	134.0	0.0		1.1
138.00		138	138.0	0.0		1.1
142.00		142	142.0	0.0		1.1
146.00		146	146.0	0.0		1.1
150.00		150	150.0	0.0		1.1
154.00		154	154.0	0.0		1.1
158.00		158	158.0	0.0		1.1
162.00		162	162.0	-0.1		1.1
166.00		166	166.0	0.0		1.1
170.00		170	170.0	0.0		1.1
174.00		174	174.0	0.0		1.1
178.00		178	178.0	0.0		1.1
182.00		182	182.0	0.0		1.1
186.00		186	186.0	0.0		1.1
190.00		190	190.0	0.0		1.1
194.00		194	194.0	0.0	1.1	
198.00		198	198.0	0.0	1.1	
202.00		202	202.0	0.0	1.1	
206.00		206	206.0	0.0	1.1	
210.00		210	210.0	0.0	1.1	
214.00		214	214.0	0.0	1.1	
218.00		218	218.0	0.0	1.1	
222.00		222	222.0	0.0	1.1	
226.00		226	226.0	0.0	1.1	
230.00		230	230.0	0.0	1.1	
234.00		234	234.0	0.0	1.1	
238.00		238	238.0	0.0	1.1	
242.00		242	242.0	0.0	1.1	
246.00		246	246.0	0.0	1.1	
250.00		250	250.0	0.0	1.1	
254.00		254	254.0	0.0	1.1	
258.00		258	258.0	0.0	1.1	
262.00		262	262.0	0.0	1.1	
266.00		266	266.0	0.0	1.1	
270.00		270	270.0	0.0	1.1	
274.00		274	274.0	0.0	1.1	
278.00		278	278.0	0.0	1.1	
282.00		282	282.0	0.0	1.1	
286.00		286	286.0	0.0	1.1	
290.00		290	290.0	0.0	1.1	
294.00		294	294.0	0.0	1.1	
298.00		298	298.0	0.0	1.1	
302.00		302	302.0	0.0	1.1	
306.00		306	306.0	0.0	1.1	
310.00		310	310.0	0.0	1.1	
314.00		314	314.0	0.0	1.1	
318.00		318	318.0	0.0	1.1	
322.00		322	322.0	0.0	1.1	
326.00		326	326.0	0.0	1.1	
330.00		330	330.0	0.0	1.1	
334.00		334	334.0	0.0	1.1	
338.00		338	338.0	0.0	1.1	
342.00		342	342.0	0.0	1.1	
346.00		346	346.0	0.0	1.1	
350.00		350	350.0	0.0	1.1	
354.00		354	354.0	0.0	1.1	
358.00		358	358.0	0.0	1.1	
362.00		362	362.0	0.0	1.1	
366.00		366	366.0	0.0	1.1	
370.00		370	370.0	0.0	1.1	
374.00		374	374.0	0.0	1.1	
378.00		378	378.0	0.0	1.1	
382.00		382	382.0	0.0	1.1	
386.00		386	386.0	0.0	1.1	
390.00		390	390.0	0.0	1.1	
394.00		394	394.0	0.0	1.1	
398.00		398	398.0	0.0	1.1	
402.00		402	402.0	0.0	1.1	
406.00		406	406.0	0.0	1.1	
410.00		410	410.0	0.0	1.1	
414.00		414	414.0	0.0	1.1	
418.00		418	418.0	0.0	1.1	
422.00		422	422.0	0.0	1.1	
426.00		426	426.0	0.0	1.1	
430.00		430	430.0	0.0	1.1	
434.00		434	434.0	0.0	1.1	
438.00		438	438.0	0.0	1.1	
442.00		442	442.0	0.0	1.1	
446.00		446	446.0	0.0	1.1	
450.00		450	450.0	0.0	1.1	
454.00		454	454.0	0.0	1.1	
458.00		458	458.0	0.0	1.1	
462.00		462	462.0	0.0	1.1	
466.00		466	466.0	0.0	1.1	
470.00		470	470.0	0.0	1.1	
474.00		474	474.0	0.0	1.1	
478.00		478	478.0	0.0	1.1	
482.00		482	482.0	0.0	1.1	
486.00		486	486.0	0.0	1.1	
490.00		490	490.0	0.0	1.1	
494.00		494	494.0	0.0	1.1	
498.00		498	498.0	0.0	1.1	
502.00		502	502.0	0.0	1.1	
506.00		506	506.0	0.0	1.1	
510.00		510	510.0	0.0	1.1	
514.00		514	514.0	0.0	1.1	
518.00		518	518.0	0.0	1.1	
522.00		522	522.0	0.0	1.1	
526.00		526	526.0	0.0	1.1	
530.00		530	530.0	0.0	1.1	
534.00		534	534.0	0.0	1.1	
538.00		538	538.0	0.0	1.1	
542.00		542	542.0	0.0	1.1	
546.00		546	546.0	0.0	1.1	
550.00		550	550.0	0.0	1.1	
554.00		554	554.0	0.0	1.1	
558.00		558	558.0	0.0	1.1	
562.00		562	562.0	0.0	1.1	
566.00		566	566.0	0.0	1.1	
570.00		570	570.0	0.0	1.1	
574.00		574	574.0	0.0	1.1	
578.00		578	578.0	0.0	1.1	
582.00		582	582.0	0.0	1.1	
586.00		586	586.0	0.0	1.1	
590.00		590	590.0	0.0	1.1	
594.00		594	594.0	0.0	1.1	
598.00		598	598.0	0.0	1.1	
602.00		602	602.0	0.0	1.1	
606.00		606	606.0	0.0	1.1	
610.00		610	610.0	0.0	1.1	
614.00		614	614.0	0.0	1.1	
618.00		618	618.0	0.0	1.1	
622.00		622	622.0	0.0	1.1	
626.00		626	626.0	0.0	1.1	
630.00		630	630.0	0.0	1.1	
634.00		634	634.0	0.0	1.1	
638.00		638	638.0	0.0	1.1	
642.00		642	642.0	0.0	1.1	
646.00		646	646.0	0.0	1.1	
650.00		650	650.0	0.0	1.1	
654.00		654	654.0	0.0	1.1	
658.00		658	658.0	0.0	1.1	
662.00		662	662.0	0.0	1.1	
666.00		666	666.0	0.0	1.1	
670.00		670	670.0	0.0	1.1	
674.00		674	674.0	0.0	1.1	
678.00		678	678.0	0.0	1.1	
682.00		682	682.0	0.0	1.1	
686.00		686	686.0	0.0	1.1	
690.00		690	690.0	0.0	1.1	
694.00		694	694.0	0.0	1.1	
698.00		698	698.0	0.0	1.1	
702.00		702	702.0	0.0	1.1	
706.00		706	706.0	0.0	1.1	
710.00		710	710.0	0.0	1.1	
714.00		714	714.0	0.0	1.1	
718.00		718	718.0	0.0	1.1	
722.00		722	722.0	0.0	1.1	
726.00		726	726.0	0.0	1.1	
730.00		730	730.0	0.0	1.1	
734.00		734	734.0	0.0	1.1	
738.00		738	738.0	0.0	1.1	
742.00		742	742.0	0.0	1.1	
746.00		746	746.0	0.0	1.1	
750.00		750	750.0	0.0	1.1	
754.00		754	754.0	0.0	1.1	
758.00		758	758.0	0.0	1.1	
762.00		762	762.0	0.0	1.1	
766.00		766	766.0	0.0	1.1	
770.00		770	770.0	0.0	1.1	
774.00		774	774.0	0.0	1.1	
778.00		778	778.0	0.0	1.1	
782.00		782	782.0	0.0	1.1	
786.00		786	786.0	0.0	1.1	
790.00		790	790.0	0.0	1.1	
794.00		794	794.0	0.0	1.1	
798.00		798	798.0	0.0	1.1	
802.00		802	802.0	0.0	1.1	
806.00		806	806.0	0.0	1.1	
810.00		810	810.0	0.0	1.1	
814.00		814	814.0	0.0	1.1	
818.00		818	818.0	0.0	1.1	
822.00		822	822.0	0.0	1.1	
826.00		826	826.0	0.0	1.1	
830.00		830	830.0	0.0	1.1	
834.00		834	834.0	0.0	1.1	
838.00		838	838.0	0.0	1.1	
842.00		842	842.0	0.0	1.1	
846.00		846	846.0	0.0	1.1	
850.00		850	850.0	0.0	1.1	
854.00		854	854.0	0.0	1.1	
858.00		858	858.0	0.0	1.1	
862.00		862	862.0	0.0	1.1	
866.00		866	866.0	0.0	1.1	
870.00		870	870.0	0.0	1.1	
874.00		874	874.0	0.0	1.1	
878.00		878	878.0	0.0	1.1	
882.00		882	882.0	0.0	1.1	
886.00		886	886.0	0.0	1.1	
890.00		890	890.0	0.0	1.1	
894.00		894	894.0	0.0	1.1	
898.00		898	898.0	0.0	1.1	
902.00		902	902.0	0.0	1.1	
906.00		906	906.0	0.0	1.1	
910.00		910	910.0	0.0	1.1	
914.00		914	914.0	0.0	1.1	
918.00		918	918.0	0.0	1.1	
922.00		922	922.0	0.0	1.1	
926.00		926	926.0	0.0	1.1	
930.00		930	930.0	0.0	1.1	
934.00		934	934.0	0.0	1.1	
938.00		938	938.0	0.0	1.1	
942.00		942	942.0	0.0	1.1	
946.00		946	946.0	0.0	1.1	
950.00		950	950.0	0.0	1.1	
954.00		954	954.0	0.0	1.1	
958.00		958	958.0	0.0	1.1	
962.00		962	962.0	0.0	1.1	
966.00		966	966.0	0.0	1.1	
970.00		970	970.0	0.0	1.1	
974.00		974	974.0	0.0	1.1	
978.00		978	978.0	0.0	1.1	
982.00		982	982.0	0.0	1.1	
986.00		986	986.0	0.0	1.1	
990.00		990	990.0	0.0	1.1	
994.00		994	994.0	0.0	1.1	
998.00		998	998.0	0.0	1.1	
1002.00		1002	1002.0	0.0	1.1	
1006.00		1006	1006.0	0.0	1.1	
1010.00		1010	1010.0	0.0	1.1	
1014.00		1014	1014.0	0.0	1.1	
1018.00		1018	1018.0	0.0	1.1	
1022.00		1022	1022.0	0.0	1.1	
1026.00		1026	1026.0	0.0	1.1	
1030.00		1030	1030.0	0.0	1.1	
1034.00		1034	1034.0	0.0	1.1	
1038.00		1038	1038.0	0.0	1.1	
1042.00		1042	1042.0	0.0	1.1	
1046.00		1046	1046.0	0.0	1.1	

Certificate No : 22-ACT-037  
Request No : Req-2022-0096

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	113.9	-0.05	113.9	0.05
				0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	29.0	0.10

#### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.8	0.10
C	28.1	0.10
Z	32.8	0.10

#### 4. Acoustic signal test of frequency weightings

(Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance
FAST / 37-139	A C Z	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(dB)
125 Hz	0.0	0.1	0.50
1000 Hz	0.0	0.0	0.60
4000 Hz	0.0	0.1	0.60
8000 Hz	-0.3	-0.5	0.70

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-037  
Request No : Req-2022-0096

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

#### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.3
134.00	134	134.0	0.0	1.3
129.00	129	129.0	0.0	1.3
124.00	124	124.0	0.0	1.3
119.00	119	119.0	0.0	1.3
114.00	114	114.0	0.0	1.3
109.00	109	109.0	0.0	1.3
104.00	104	104.0	0.0	1.3
99.00	99	99.0	0.0	1.3
94.00	94	93.9	-0.1	1.3
89.00	89	88.9	-0.1	1.3
84.00	84	83.9	-0.1	1.3
79.00	79	78.9	-0.1	1.3
74.00	74	73.9	-0.1	1.3
69.00	69	69.0	0.0	1.3
64.00	64	64.0	0.0	1.3
59.00	59	59.0	0.0	1.3
54.00	54	54.0	0.0	1.3
49.00	49	49.0	0.0	0.8
44.00	44	44.1	0.1	1.1
39.00	39	39.4	0.4	1.1
34.00	34	34.5	0.5	1.1
29.00	29	29.6	0.6	1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-037  
Request No : Req-2022-0096

#### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance
FAST / 37-139	A (dB) C (dB) Z (dB)	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)
63 Hz	-0.2	-0.1	0.0
125 Hz	-0.1	0.0	0.0
250 Hz	-0.1	0.0	0.0
500 Hz	-0.1	0.0	0.0
1000 Hz	0.0	0.0	0.0
2000 Hz	0.0	0.0	0.0
4000 Hz	0.0	0.0	0.0
8000 Hz	-0.1	-0.1	0.0
16000 Hz	-0.1	-0.1	-0.1

#### 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Log	114.00	114.0	0.0	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-037  
Request No : Req-2022-0096

#### 9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	44.1	44.2	0.1	0.3
	114	114.0	0.0	1.3

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Timeburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1.3
	2	118.0	117.7	-0.3	+1.0, -2.5
	0.25	109.0	108.8	-0.2	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1.3
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.1	+0.1	1.3
	2	109.0	108.9	-0.1	+1.0, -2.5
	0.25	108.0	108.0	0.0	+1.5, -5.0

#### 11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.  
เอกสารไม่ควบคุม



Certificate No : 22-ACT-037  
Request No : Req-2022-0096

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	( $\pm$ dB)	( $\pm$ dB)
STD Setting	(dB)		
Positive one-half cycle	142.9		
Negative one-half cycle	142.9		
Deviated	0.0	0.2	1.5

#### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	( $\pm$ dB)	( $\pm$ dB)
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. Date 31/07/19

เอกสารไม่ควบคุม

#### Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Name : 8/ Soi Udornik 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok  
Address : 10260  
Certificate No : 22-ACT-248  
Request No : Req-2022-0828

#### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005544  
ID : UAEFPM0412563  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone SN : 329362  
Preamplifier Model : P8MLAT2C  
Preamplifier SN : 071494  
Instrument Status : Used

#### Calibration Environment and Details


Temperature : 23 °C  $\pm$  2 °C  
Humidity : 30 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 23 March 2022  
Calibrated Date : 1 April 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration : Lab Acoustic

#### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	180273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EPA000234	14 June 2022	TSI
Audio Generator	Swamk	Swam001	131	18 October 2022	WK Electric

#### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Mr. Noppadol Luangrat  
Calibration Officer

Approved By :   
Mr. Pait Mahachon  
Calibration Engineer Supervisor  
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. Date 31/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	113.7	-0.15	113.9	0.05
				( $\pm$ dB)	( $\pm$ dB)

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 31A, SN:58079

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	28.1	0.10

#### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	28.5	0.10
C	28.4	0.10
Z	32.6	0.10

#### 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit
FAST / 37-139	A C Z	( $\pm$ dB)	( $\pm$ dB)
STD Setting	(dB) (dB) (dB)		
125 Hz	0.0 0.1 0.1	0.30	2.0
1000 Hz	0.0 0.0 0.0	0.00	1.0
4000 Hz	0.2 0.2 0.2	0.60	3.0
8000 Hz	0.0 0.0 0.1	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. Date 31/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

#### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit
FAST / 37-139	A (dB) C (dB) Z (dB)	( $\pm$ dB)	( $\pm$ dB)
STD Setting			
63 Hz	-0.2 -0.1 -0.1		2.0
125 Hz	-0.1 0.0 0.0		1.5
250 Hz	-0.1 0.0 0.0		1.5
500 Hz	-0.1 0.0 0.0		1.5
1000 Hz	0.0 0.0 0.0	0.2	1.0
2000 Hz	0.0 0.0 0.0		2.0
4000 Hz	0.0 0.0 0.0		3.0
8000 Hz	-0.1 -0.1 0.0		5.0
18000 Hz	-0.1 -0.1 -0.1		>5, -DNF

#### 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / 37-139	REF	UUC	ERR	
UUC Weighting	(dB)	(dB)	(dB)	( $\pm$ dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
37-139 / A	REF	UUC	ERR	
UUC Time Response	(dB)	(dB)	(dB)	( $\pm$ dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Long	114.00	114.0	0.0	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. Date 31/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviant	0.0	0.3	0.3

#### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	REF	UUC	ERR	
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	98.9	-0.1	1.1
94.00	94	94.0	0.0	1.1
89.00	89	89.0	0.0	1.1
84.00	84	84.0	0.0	1.1
79.00	79	79.0	0.0	1.1
74.00	74	74.0	0.0	1.1
69.00	69	69.0	0.0	1.1
64.00	64	64.0	0.0	1.1
59.00	59	59.0	0.0	1.1
54.00	54	54.0	0.0	1.1
49.00	49	49.0	0.0	1.1
44.00	44	44.1	0.1	1.1
39.00	39	39.4	0.4	1.1
34.00	34	34.5	0.5	1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing calibration laboratory.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

#### 9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF	UUC	ERR	
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	44.2	44.8	0.2	1.1
	114	114.0	0.0	1.1

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst	Ref	UUC	ERR	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1.0
	2	118.0	117.7	-0.3	+1.0, -2.5
	0.25	109.0	108.6	-0.2	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1.0
	2	109.0	108.9	-0.1	+1.0, -5.0
SEL	200	129.0	129.1	+0.1	1.0
	2	109.0	109.1	+0.1	+1.0, -2.5
	0.25	100.0	100.0	0.0	+1.5, -5.0

#### 11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 85-142	REF	UUC	ERR	
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.7	-0.70	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing calibration laboratory.  
เอกสารไม่ควบคุม

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	143.2		
Negative one-half cycle	143.1		
Deviant	0.1	0.2	1.5

#### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Initial	129.0		
Final	129.0		
Deviant	0.0	0.3	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing calibration laboratory.  
เอกสารไม่ควบคุม

Calibration Certificate ID  
TH2020-097-040722-ACC-TH

**METTLER TOLEDO**

Mettler-Toledo (Thailand) Ltd.  
646/4 - 64/5 Lasele Rd., Bangna Tai Sub-District,  
Bangna District, Bangkok 10260  
+66 2723 0362  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number: 00152455004

### Weighing Device

Manufacturer: Mettler Toledo  
Model: AR204-S  
Serial No.: 1128312528  
Building: N/A  
Floor: 2  
Room: Balance Room 2 (208)  
Instrument Type: Weighing Instrument  
Asset Number: UAE.AIR.019/2550  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CIPW002/20  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.5 °C End: 21.4 °C	Start: 56.1 % End: 63.2 %

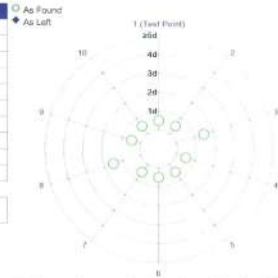
As Found Calibration Date: 01-Apr-2022  
As Left Calibration Date: N/A  
Issue Date: 06-Apr-2022  
Calibration: Sittawat Chomchuan  
Approved Signatory: Sittawat Chomchuan  
Kessakorn Tassanachatsakul  
Santi Jitvijayom  
Surachet Sukkote

## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A



The "1d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0002 g	N/A

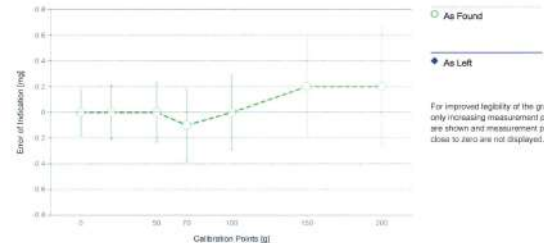


The "1d" in the graph represents the readability of the range/interval in which the test was performed.

## Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.19 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.25 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.43 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.48 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k = 2$  according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

### Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set No.: OIML E2

Weight Set No.:	W580	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	JN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

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## Remarks

Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filter pan: 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

## Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. This formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:	$3.0 \cdot 10^{-4} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use:	3 K

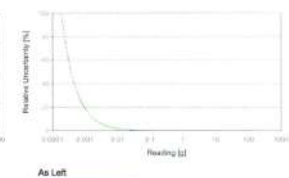
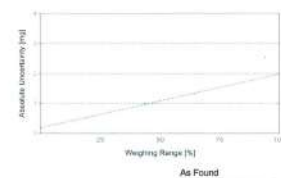
### Linearization of Uncertainty Equation

Range	As Found	As Left
d Max		
1 0.0001 g 220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

### Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.0020 g	0.19 mg 0.86%	N/A
0.2200 g	0.19 mg 0.087%	N/A
2.2000 g	0.21 mg 0.0095%	N/A
22.0000 g	0.37 mg 0.0017%	N/A
220.0000 g	2.0 mg 0.0009%	N/A



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เอกสารไม่ควบคุม



Mettler-Toledo (Thailand) Ltd.  
848/4 - 848/5 Lassaie Rd., Bangna Tai Sub-District,  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong Contact: Suret Chonrak  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number: 

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S/FACT Asset Number: UAE.AIR.016/2550  
Serial No.: B108115858 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (006)

Range	Max. Capacity	Readability (g)
1	220 g	0.0001 g

### Procedure

Calibration Guideline: EURAMET cg-16 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CPW002/09

This calibration certificate contains measurements for As Found and As Left calibrations.  
The sensitivity/linearity of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.  
In accordance with EURAMET cg-16 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

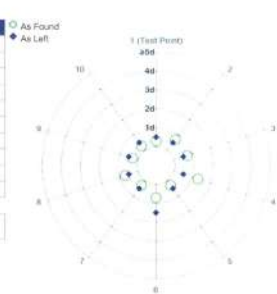
	Temperature	Humidity
As Found	Start: 22.5 °C End: 22.1 °C Start: 58.0 % End: 51.9 %	
As Left	Start: 22.3 °C End: 22.4 °C Start: 48.2 % End: 55.8 %	

As Found Calibration Date: 07-Apr-2022 Calibrator:   
As Left Calibration Date: 07-Apr-2022  
Issue Date: 08-Apr-2022  
Approved Signatory:   
☒ Kasakorn Tassanachaisakul  
☐ Saree Jintayom  
☐ Surachet Sukkate

## Measurement Results

### Repeatability

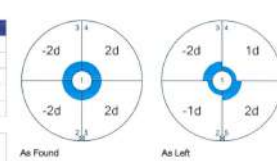
Test Load: 100 g	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9999 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g
Standard Deviation	0.00007 g	0.00007 g



The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g	Position	As Found	As Left
1	1	100.0005 g	100.0000 g
2	2	100.0003 g	99.9999 g
3	3	100.0003 g	99.9999 g
4	4	100.0007 g	100.0000 g
5	5	100.0007 g	100.0000 g
Maximum Deviation		0.0002 g	0.0002 g

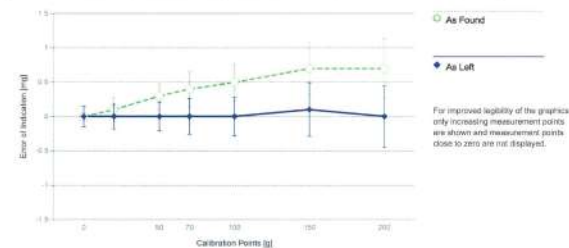


The "d" in the graph represents the readability of the range/interval in which the test was performed.

### Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.16 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.36 mg	2
11	200.0001 g	200.0006 g	0.0005 g	0.44 mg	2

As Left	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.16 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.26 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k = 2, which can be larger than 2 according to EURAMET cg-16. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

### Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

#### Weight Set 1: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022  
Certificate Number: C208581831 Calibration Due Date: 14-Aug-2023

#### Thermo Hygrometer

Equipment No.: IN181 Date of Issue: 14-Jun-2021  
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

### Remarks

FACT adjustment functionality activated  
Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

#### End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $2.5 \cdot 10^{-4} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

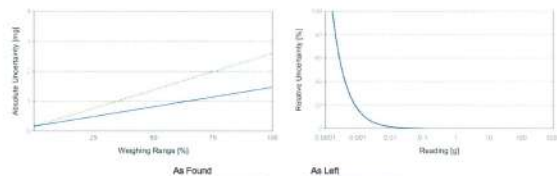
Uncertainty of Uncertainty Equation

Range	As Found	As Left
d	Max	
1 0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$ $U_1 = 0.16 \text{ mg} + 0.00992 \text{ mg/g} \cdot R$

To optimize the stability of the inscription, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.0220 g	0.16 mg	0.16 mg
0.2200 g	0.16 mg	0.16 mg
2.2000 g	0.16 mg	0.17 mg
22.0000 g	0.40 mg	0.29 mg
220.0000 g	2.6 mg	1.5 mg



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Calibration Certificate

Certificate No.: 2202093-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 1230525212  
ID No.: UAE.WAS.003/2563  
Order No.: 2202093  
Operation No.: 2202093-001  
Date of Receipt: 11 March 2022  
Date of Calibration: 16 March 2022

Calibrated by: Mr Manas Somsak Specialist  
Approved by: (Mr.Pheraphat Tuanjit) Manager, Division of Calibration Laboratory  
Date of Issue: 21 March 2022  
Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2202093-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 1230525212  
Type: Bench top  
ID No.: UAE.WAS.003/2563

Date of Calibration: 16 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute.  
Environment Condition: Ambient Temperature: (  $23.0 \pm 1.5$  ) °C Relative Humidity: (  $45.5 \pm 5$  ) %  
Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: In house method: W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM).

2. Reference Standards / Certified Reference Material

Instrument	Serial ID No.	Manufacturer	Certificate No.	Exp. Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640589-01	30 October 2022
2.3 Thermo-Hygro Meter	802 ALBTH 00058	POHPE	QR21-2767	16 November 2022

Certified Reference Material

Lot No.	Manufacturer	Set N	Expires Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	CPAchem	PHQ16.L5	21 November 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	CPAchem	PHQ17.L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	CPAchem	PHQ20.L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	CPAchem	PHI07.L5	8 November 2022

3. This certificate is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0282
3.4 Certified Reference Material No. 2.4 to 2.6	Traceable to	Primary measurement method: Homed acid using calibrated thermocouple, thermometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7	Traceable to	BSI RnH H-7 Lot# 30.04.2020; BSI RnH H-6 Lot# 28.05.2020; BSI RnH H-8 Lot# 16.04.2020; BSI RnH H-9 Lot# 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument was calibrated.

5. The result of calibration was found accurate as shown on date and place of calibration only.

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Calibration Report

Certificate No.: 2202093-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 1230525212  
Type: Bench top  
ID No.: UAE.WAS.003/2563

Date of Calibration: 16 March 2022 Page 3 of 5

Calibration Results:  
1. Calibration of pH Meter ( Manual Temperature Compensation at 25 °C )

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (± mV)	Coverage Factor (k)
		mV	pH		
0	414.117	414	0.00	0.58	2.00
2	295.811	296	2.00	0.58	2.00
4	177.462	178	4.00	0.58	2.00
6	59.159	59	6.00	0.58	2.00
7	-0.961	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.463	-177	10.00	0.58	2.00
12	-295.812	-296	12.00	0.58	2.00
14	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )

Equipment: pH Electrode  
Manufacturer: METTLER TOLEDO  
Serial No.: 8453943  
Type: Combined Electrode  
ID No.: N/A

Performance of Electrode system: (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	172	98.1	0.0071	2.00
6.866	6.87	8	-	0.0074	2.00
10.015	10.01	-175	97.4	0.0090	2.00
6.863	6.98	-3	-	0.0082	2.00

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## Calibration Report

**Certificate No.:** 2202993-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1230525212 ID No.: UAE.WAS.0032953  
Manufacturer: METTLER TOLEDO  
**Date of Calibration:** 16 March 2022 Page 4 of 5  
**Location:** Chemical Calibration Laboratory, National Food Institute.  
**Environment Condition:** Ambient Temperature: ( 23.0 ± 1.0 ) °C  
Relative Humidity: ( 50 ± 4 ) %

### Condition of this results of Calibration:

1. Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

### 2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 085164	24-Jun-22	TSTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 3415922

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated Item: ☒ Good  
7. Result of Calibration: ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

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## Calibration Report

**Certificate No.:** 2202993-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1230525212 ID No.: UAE.WAS.0032953  
Manufacturer: METTLER TOLEDO  
**Date of Calibration:** 16 March 2022 Page 5 of 5  
**Calibration point:** 15.0, 25.0 and 35.0 °C  
**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model: N/A SN: N/A
- Dimension of probe: Diameter 3.8 mm, Length 135 mm.
- Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	15.001	-0.2	0.099
25.2	25.002	-0.2	0.099
35.2	35.002	-0.2	0.099

Note: - UUC\*: Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61


เอกสารไม่ควบคุม

## Calibration Certificate

**Certificate No.:** 2203527-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Order No.:** 2203527  
**Operation No.:** 2203527-001  
**Date of Receipt:** 30 June 2022  
**Date of Calibration:** 5 July 2022

**Calibrated by** Mr.Worapob Sooktong **Approved by**   
Scientist ( Mr.Pharaphat Tuanra )  
Manager, Division of Calibration Laboratory  
**Date of Issue:** 5 July 2022 **Responsible for the Technical Management Team**

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** pH Meter  
Resolution: 0.01 pH ± 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**Type:** Bench top  
**ID No.:** UAE.WAT.009/2564  
**Date of Calibration:** 5 July 2022 Page 2 of 5

**Location:** Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: ( 23.5 ± 1.5 ) °C **Relative Humidity:** ( 55 ± 5 ) %  
**Condition of Equipment:** Good Condition

### Condition of this Results of Calibration

1. Calibration Method: In house method: W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

### 2. Reference Standards / Certified Reference Material

Instruments	Serial/ ID No.	Manufacturer	Certificate No.	Due Date	
2.1 DC Voltage Calibrator	2709007	Fluke	22E1959	17 June 2023	
2.2 Digital Thermometer	2709007	Fluke	CC-640509-01	30 October 2022	
2.3 Thermo-Hygro Meter	NPL8TH00518	PONPE	GR22-0351	18 February 2023	
Certified Reference Material		Lot No.	Manufacturer	Ref. No.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	805203	CPAchem	PHQ16.LS		21 April 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	805204	CPAchem	PHQ17.LS		21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	805205	CPAchem	PHQ20.LS		21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	805206	CPAchem	PHQ17.LS		21 April 2023

### 3. This certification is traceable to the International System of Unit (SI Unit)

- 3.1 Instruments No.2.1 through NSC-TS-18/17025 Laboratory Accreditation of Calibration No.0879
- 3.2 Instruments No.2.2 through NSC-TS-18/17025 Laboratory Accreditation of Calibration No.0861
- 3.3 Instruments No.2.3 through NSC-TS-18/17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanopipette. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No.2.7 traceable to BIM RefN H-27 LoN 04.06.2021; BIM RefN H-28 LoN 28.05.2021; BIM RefN H-27 LoN 04.06.2021; BIM RefN H-28 LoN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ± 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**Type:** Bench top  
**ID No.:** UAE.WAT.009/2564  
**Date of Calibration:** 5 July 2022 Page 3 of 5

**Calibration Results:** 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0	-414.117	414	0.00	0.00	2.00
2	295.811	296	2.20	0.00	2.00
4	177.462	177	4.00	0.00	2.00
6	59.159	59	6.00	0.00	2.00
7	-0.001	0	7.20	0.00	2.00
8	-59.159	-59	8.00	0.00	2.00
10	-177.463	-177	10.00	0.00	2.00
12	-295.812	-296	12.00	0.00	2.00
14	-414.119	-414	14.00	0.00	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

**Equipment:** pH Electrode  
**Type:** Combined Electrode  
**Manufacturer:** METTLER TOLEDO  
**Model:** InLab Expert Pro-ISM  
**Serial No.:** 2210418  
**ID No.:** NA

**Performance of Electrode system:** (Three-Point Calibration at pH7, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.010	192	-	0.0071	2.00
6.865	6.865	14	100.0	0.0076	2.00
10.008	10.010	-168	97.9	0.0089	2.00
6.965	6.980	8	-	0.0087	2.00

F-C5-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 5 July 2022 Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C  
**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe: S/N : -
- Dimension of probe: Diameter 9 mm, Length 120 mm,
- Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.038	- 0.1	0.12
25.1	25.038	- 0.1	0.12
35.2	35.024	- 0.2	0.12

**Note**  
- UUC\* : Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

F-C5-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 5 July 2022 Page 4 of 5

**Location:** Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 25 °C ± 1 °C  
Relative Humidity 48 % ± 3 %

**Condition of this results of Calibration:**

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.  
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.  
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 650057-01	10-Dec-22	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-C5-012 Revision: 01 Date: 20-04-65



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
3341 PATTANAKARN ROAD SOI 19, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL: 0-2717-3880-37 FAX: 0-2717-9484



**Cert.No.:** 22MM210  
**Page:** 1 of 3

## Certificate of Calibration

**Equipment :** Electronic Balance  
**Manufacturer :** Mettler Toledo  
**Model :** XSR205  
**Serial No. :** C009071872  
**ID No. :** UAE.WAO.012/2563  
**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udumuk 41, Sukhumvit Road,  
Bangchak, Phakhanong,  
Bangkok 10260

**Location :** Balance Room

**Received order :** 26 April 2022  
**Calibration Date :** 26 April 2022  
**Ambient Temperature :** 15 °C to 40 °C  
**Relative Humidity :** 30 % to 90 %

**Calibrated by :** Kunohit Promprat

**Approved by :**   
( ) Ponthipha Tameyakul  
( ) Maloo Butkrua  
( ) Suwit Imjai

**Issue Date :** 29 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2204-0542OC-1  
**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15894	-	70RC138	MM-0009-21	3 Feb 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

Range capacity : 0 g to 81 g Resolution 0.00001 g  
61 g to 220 g Resolution 0.0001 g

**Before Adjustment :**

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00004	-0.00004	0.15	2.00
200	199.9999	+0.0001	0.35	2.00

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000008
200	0.00005

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เอกสารไม่ควบคุม

**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2204-0542OC-1  
**Result of calibration**

**2. Effect of off center loading**  
A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0002	-0.0001	0.0000	-0.0002	-0.0002	0.0002

**3. Departure from nominal value**

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
0.1	0.10001	-0.00001	0.017	2.11
1	1.00002	-0.00002	0.019	2.05
5	5.00003	-0.00003	0.026	2.00
20	20.00008	-0.00008	0.049	2.00
50	50.00010	-0.00010	0.080	2.00
80	80.00014	-0.00014	0.15	2.00
100	100.0001	-0.0001	0.21	2.00
150	150.0001	-0.0001	0.29	2.00
200	200.0001	-0.0001	0.35	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD BOX 18, SUANLADANG, SUANLADANG BANGKOK, 10250  
TEL: 0-2713-3809-37 FAX: 0-2719-9484

**Cert. No.:** 22TM1490  
**Page:** 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven  
**Manufacturer :** Memmert  
**Model :** UF 55  
**Serial No. :** B218.1666  
**ID No. :** UAE.WAO.027/2559  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.,  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2  
**Received Order :** 19 October 2022  
**Calibration Date :** 19 October 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Preecha Hiahib  
**Approved by :**   
Approved Signatory  
( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ✓ ) Suwit Imjai  
**Issue Date :** 31 October 2022

The Uncertainties are for a confidence probability of approximately 95 %

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เอกสารไม่ควบคุม

**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2210-0575OC-1  
**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY41021843	Z2LM4	10 Jan 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Environment during calibration**

	Beginning	Finished
Temp. ( °C )	29	30
REL Humid. ( % )	47	40
AC Supply ( Volt )	221	220

**Ref. Std. ID No. : @ Calibration Point**

Position :	( 104 ) °C	( 140,180 ) °C
1	18-04RTD-01	21-04TC-01
2	18-04RTD-02	21-04TC-02
3	18-04RTD-03	21-04TC-03
4	18-04RTD-04	21-04TC-04
5	18-04RTD-05	21-04TC-05
6	18-04RTD-06	21-04TC-06
7	18-04RTD-07	21-04TC-07
8	18-04RTD-08	21-04TC-08
9 (ref.)	18-04RTD-09	21-04TC-09

**Probe Installation Details :**

**Dimension of Chamber :**

a = 5.0 cm	D = 0.33 m
b = 5.0 cm	W = 0.40 m
c = 5.0 cm	H = 0.40 m
	Capacity = 0.053 m³

เอกสารไม่ควบคุม





Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2210-05750C-1  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 22TM1490  
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
104.0	104.0	104.0	0.061	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.687	104.426	104.012	103.928	104.370
140.0	138.199	139.189	138.808	139.550	140.266	139.622	139.283	139.385	140.389
180.0	177.930	179.267	178.643	179.753	181.011	180.093	179.496	179.743	181.278

Average\* : The average of 30 values in each position.  
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation UUC\* : Unit Under Calibration  
 Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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## Calibration Certificate

Certificate No.: 2202934-001-01  
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 Address: 3 Sol Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Order No.: 2202934

Operation No.: 2202934-001

Date of Receipt: 13 May 2022

Date of Calibration: 13 May 2022

Calibrated by Mr.Manas Somsak Specialist  
 Approved by ( Mr.Pheraphat Tuanjit )  
 Manager, Division of Calibration Laboratory  
 Responsible for the Technical Management Team  
 Date of Issue: 25 May 2022

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



## Calibration Report

Certificate No.: 2202934-001-01  
 Equipment: Electronic Balance  
 Manufacturer: METTLER TOLEDO  
 Model: XSR204  
 Resolution: 0.0001 g  
 Serial No.: C117635043  
 ID No.: UAE.WAS.012/2564  
 Capacity: 220 g

Date of Calibration: 13 May 2022 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unloaded	0.00000	0.0000	0.0000	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02000	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00001	1.0000	0.0000	0.000085	2.00
2	2.00003	2.0000	0.0000	0.000085	2.00
3	3.00004	3.0000	0.0000	0.000085	2.00
5	5.00007	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00004	20.0000	0.0000	0.000092	2.00
30	30.00005	30.0001	-0.0001	0.00010	2.00
40	40.00008	40.0001	0.0000	0.00011	2.00
45	45.00019	45.0001	0.0000	0.00013	2.00

F-CS-012 Revision: 01 Date: 20-04-65



## Calibration Report

Certificate No.: 2202934-001-01  
 Equipment: Electronic Balance  
 Manufacturer: METTLER TOLEDO  
 Model: XSR204  
 Resolution: 0.0001 g  
 Serial No.: C117635043  
 ID No.: UAE.WAS.012/2564  
 Capacity: 220 g

Date of Calibration: 13 May 2022 Page 2 of 4

Environment Condition: Ambient Temperature: 22.3 ± 0.1 °C Relative Humidity: 47 ± 3 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-HA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M22041375	23 April 2023
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	POHPE 490	NFI.BTH 010/18	Quality Return	QR22-0350	18 February 2023

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Readings:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000033
200	0.000032

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.000	50.000	50.000	50.000	50.000	50.000	0.000

F-CS-012 Revision: 01 Date: 20-04-65

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NFI 0000



ศูนย์บริการและพัฒนากลุ่มอาหาร  
ศูนย์บริการและพัฒนากลุ่มอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Report

Certificate No.: 2202934-001-01

Equipment: Electronic Balance  
Model: XSR204  
Serial No.: C117635043  
Capacity: 220 g

Manufacturer: METTLER TOLEDO  
Resolution: 0.0001 g  
ID No.: UAE.WAS.02/2564

Date of Calibration: 13 May 2022

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor k
50	50.00004	50.0001	-0.0001	0.00011	2.00
55	55.00006	55.0001	0.0000	0.00012	2.00
60	60.00005	60.0001	-0.0001	0.00012	2.00
65	65.00007	65.0002	-0.0001	0.00013	2.00
70	70.00008	70.0002	-0.0001	0.00013	2.00
75	75.00010	75.0002	-0.0001	0.00013	2.00
80	80.00009	80.0002	-0.0001	0.00014	2.00
85	85.00011	85.0002	-0.0001	0.00014	2.00
90	90.00012	90.0002	-0.0001	0.00015	2.00
100	100.00009	100.0003	-0.0002	0.00016	2.00
120	120.00011	120.0003	-0.0002	0.00018	2.00
150	150.00012	150.0004	-0.0003	0.00021	2.00
200	200.00015	200.0004	-0.0003	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k$ , providing a level of confidence of approximately 95 %.

\*\*\*\*\* End \*\*\*\*\*

FCS-012 Revision: 01 Date: 20-04-65



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3008-27 FAX: 0-2719-9484



## Certificate of Calibration

Cert. No.: 22TM90  
Page.: 1 of 3

Equipment: BOD Incubator

Manufacturer: Arco

Model: UC4-1320

Serial No.: 13URC4S013201

ID No.: UAE.WAO.015/2561

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsak 41, Sukhumvit Road,  
Bangkok, Phrakhanong,  
Bangkok 10260

Location: Lab Floor 2

Received Order: 17 February 2022

Calibration Date: 17 February 2022

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Kunchit Promrat

Approved by:   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkrua  
( ) Suwit Imjai

Issue Date: 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the Head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม  
A 0038099



Equipment: BOD Incubator  
Condition As-Received: Used Item  
Reference: 2202-0446OC-1

Cert. No.: 22TM90  
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

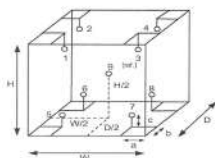
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit.

Result of Calibration :- ( ) Without Adjustment

Function of UUC\*: Temperature Source

Fresh air setting: Not Available



Probe Installation Details:

a = 10 cm  
b = 10 cm  
c = 10 cm

Dimension of Chamber:

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL Humid. (%)	68	75
AC Supply (Volt)	226	226

Position:	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09



Equipment: BOD Incubator  
Condition As-Received: Used Item  
Reference: 2202-0446OC-1

Cert. No.: 22TM90  
Page.: 3 of 3

Result of Calibration :-

Function of UUC\*: Temperature Source

Fresh air setting: Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824	19.922

Average\*: The average of 30 values in each position.

Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\*: Unit Under Calibration

Note: The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k$ , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม  
A 1096042

เอกสารไม่ควบคุม  
A 1096041



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM563  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V615.0187  
ID No. : UAE.MIC.003/2559  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Prawit Sodavitchit

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040248



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2204-00160C-1  
Procedure Used :-

Cert. No.: 22TM563  
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

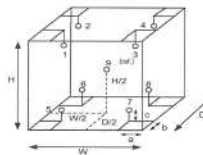
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	26	26
REL Humid. ( % )	60	62
AC Supply ( Volt )	220	220

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม

a 1104310



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2204-00160C-1  
Result of Calibration :- ( ° ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM563  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
35.0	35.0	35.0	0.12	0.53	0.79	0.30	2

Measured Temperature ( °C )									
Position									
Calibration Point ( °C )	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.170	35.167	34.938	34.844	34.816	34.854	34.584	34.730	34.780

Average\* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1104309



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM565  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L414.1407  
ID No. : UAE.MIC.006/2558  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Prawit Sodavitchit

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2204-0016OC-4  
 Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date  
 1) Data Acquisition 34970A MY44067817 Z1LM10 20 Jul 2022

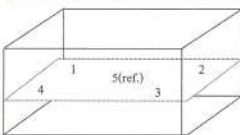
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	26	62	220
Finished of Calibration	26	65	220



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

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Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2204-0016OC-4  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.424	44.409	44.478	44.470	44.581

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.22	0.039	0.15	2

Average\* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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Calibration Certificate ID  
 TH2058-098-040722-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.  
 840/4 - 840/5 Laksale Rd., Bangna Tai Sub-District,  
 Bangna District, Bangkok 10260  
 +66 2723 0382  
 MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

#### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
 Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
 City: Phra Khanong  
 Zip / Postal: 10260  
 State / Province: Bangkok  
 Order Number:

#### Weighing Device

Manufacturer: Mettler Toledo  
 Model: MS6035D1  
 Serial No.: B067010311  
 Building: 2  
 Floor: Balance Room (206)  
 Instrument Type: Weighing Instrument  
 Asset Number: UAE.MC.008/2533  
 Terminal Model: N/A  
 Terminal Serial No.: N/A  
 Terminal Asset No.: N/A

Range	Max. Capacity	Readability (g)
1	620 g	0.001 g

#### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
 METTLER TOLEDO Work Instruction: CPW003.00  
 This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
 The sensitivity/linearity of the weighing instrument was adjusted before calibration with a built-in weight.  
 In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.8 °C End: 23.0 °C	Start: 49.9 % End: 58.3 %

As Found Calibration Date: 07-Apr-2022  
 As Left Calibration Date: N/A  
 Issue Date: 08-Apr-2022  
 Calibration:   
 Approved Signatory:

Kasornkorn Tassanachaisakul  
 Sant Jirayon  
 Surachet Sukkiale

Software Version: 1.23.0.288  
 Report Version: 1.16.13  
 Form Number: F100C

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Page 1 of 5

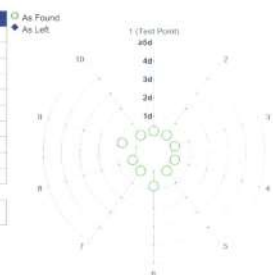
Calibration Certificate ID  
 TH2058-098-040722-ACC-TH

METTLER TOLEDO Service

## Measurement Results

#### Repeatability

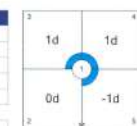
Test Load: 200 g		
	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A
Standard Deviation	0.0004 g	N/A



The "s" in the graph represents the readability of the range/interval in which the test was performed.  
 The results of the graph are based upon the absolute values of the differences from the mean value.

#### Eccentricity

Test Load: 200 g		
Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A



The "s" in the graph represents the readability of the range/interval in which the test was performed.

Software Version: 1.23.0.288  
 Report Version: 1.16.13  
 Form Number: F100C

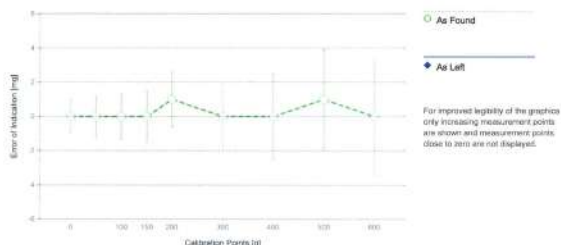
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Page 2 of 5

## Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k=2$  which can be larger than 2 according to EURAMET cg-16. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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## Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

### Weight Set 1: OIML F1

Weight Set No.: W555 Date of Issue: 09-Jul-2021  
Certificate Number: CCM-0137-21-C Calibration Due Date: 07-Jul-2022

### Weight Set 2: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022  
Certificate Number: C298581631 Calibration Due Date: 14-Aug-2023

### Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021  
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

## Remarks

FACT adjustment functionality activated  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

### End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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## Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-4} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

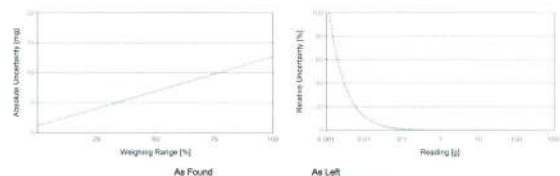
### Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.001 g	620 g	$U_1 = 1.2 \text{ mg} + 0.0186 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

### Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.002 g	1.2 mg	N/A
0.620 g	1.2 mg	N/A
6.200 g	1.3 mg	N/A
62.000 g	2.4 mg	N/A
620.000 g	13 mg	N/A



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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9464

IAC-MRA  
ISO/IEC 17025:2018  
CALIBRATION 9999

Cert. No.: 22TM89  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Autoclave

**Manufacturer :** ALP

**Model :** CL-40L

**Serial No. :** 802664

**ID No. :** UAE.MIC.014/2550

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

**Location :** Air Analysis Unit

**Received Order :** 17 February 2022  
**Calibration Date :** 17 February 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Kunchit Promprat

**Approved by :**

( ) Pornthippa Tameyaykul  
( ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 22 February 2022

**Approved Signatory**

**The Uncertainties are for a confidence probability of approximately 95%**

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Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2202-0444OC-1

Cert. No.: 22TM89  
Page.: 2 of 3

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.  
The temperature scale used was based on ITS-90.

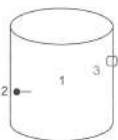
#### Condition of this result of calibration

##### 1. Reference standard instrument:-

- | Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34970A | MY44035217 | 21LM30    | 23 Dec 2022 |
- This certificate is valid only to the item calibrated on date and place of calibration.
  - This certification is traceable to the International System of Unit.
  - This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*
  - (\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 ) It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.
- This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source



	Environmental		
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	27	68	226
Finished of Calibration	27	65	226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

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๑ 1096061



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2202-0444OC-1

Cert. No.: 22TM89  
Page.: 3 of 3

#### Result of Calibration :- ( \* ) Without Adjustment

Operating parameter Set : Temperature = 122 °C  
Sterilization period = 30 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

Average\* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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๑ 1096061



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SIAM LIANG, SIAM LIANG, BANGKOK, 10250  
TEL: 0-2717-0880-24 FAX: 0-2719-9484

### Certificate of Calibration

Certificate No.: 22P801  
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model: 1221-38-W/M

Serial No.: -

ID No.: UAE.EFM.178/2561

Condition As-Received: Used Item

Received Date: 03 March 2022

Calibration Date: 12 March 2022

Reference: 2205-0131WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,  
Phrahanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

#### Condition of this result of calibration

##### 1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O
- This instrument was used clean air as pressure media.
- This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
- This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained at:-  
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree  
Issue Date : 14 March 2022

Approved Signatory : AHapol P.  
( ) Phallinee Pratsapaipal  
( ) Sura Suwanmasri  
(x) AHapol Panurach

เอกสารไมค์ควบคุม

๑ 0282414



Cert.No.: 22P801  
Page: 2 of 2

#### Result of calibration:- Without adjustment

Function:- Pressure Measurement  
Increasing Pressure

Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O

Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate)

Applied Pressure (inH <sub>2</sub> O)	UUC Indication		ΔP (inH <sub>2</sub> O)	Error (inH <sub>2</sub> O)
	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)		
0.00	0.00	0.00	0.00	0.00
2.00	0.98	-0.94	1.92	-0.08
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.02	-5.98	11.98	-0.02
14.00	7.02	-6.98	13.98	-0.02
16.00	8.04	-7.98	16.02	0.02
18.00	9.04	-8.98	18.02	0.02
20.00	10.04	-9.98	20.02	0.02
22.00	11.06	-10.98	22.04	0.04
24.00	12.06	-12.00	24.06	0.06
26.00	13.06	-13.00	26.06	0.06
28.00	14.08	-14.02	28.10	0.10
30.00	15.08	-15.02	30.10	0.10
32.00	16.08	-16.04	32.12	0.12
34.00	17.10	-17.04	34.14	0.14
36.00	17.90	-17.86	35.76	-0.04

The uncertainty of measurement was ± 0.11 inH<sub>2</sub>O

\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k* = 2, providing a level of confidence of approximately 95 %.

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๑ 109525



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL: 0-2717-3000-24 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 22P2728  
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE-ANV.152/2550

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: ( 23 ± 2 ) °C

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phraekhong, Bangkok 10260

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using 'DKD-R 6-1', Calibration of Pressure Gauges, Edition 03/2014 as a guidelines.

### Condition of this result of calibration

#### 1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0076-22	02 May 2023

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3. This result of calibration was made on requested at the point specified by customer.

4. This result of calibration instrument was in absolute pressure.

5. This instrument was used clean air as pressure media.

6. The certificate is valid only to the item calibrated on date and place of calibration.

7. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarnee  
Issue Date: 25 July 2022

Approved Signatory:   
[ ] Phatinee Prapbopal  
[ ] Sura Suwanasri  
[x] Attapol Panurech

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Cert.No.: 22P2728  
Page: 2 of 2

### Result of calibration:- Without adjustment

Range: 960 hPa to 1030 hPa

#### Function:- Absolute Pressure Measurement

Scale Interval: 1 hPa (The Fifth Estimate)

##### Increasing Pressure

Applied Pressure (hPa)	955.27	967.46	978.89	989.56	999.89	1009.89	1020.55	1031.06
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	3.73	2.54	1.11	0.44	0.15	0.11	-0.55	-1.06

##### Decreasing Pressure

Applied Pressure (hPa)	1031.19	1020.73	1009.81	999.92	989.72	979.13	967.71	956.64
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-1.19	-0.73	0.09	0.08	0.28	0.87	2.29	3.36

The uncertainty of measurement was ± 0.30 hPa

\* UUC = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL: 0-2717-3000-24 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 22H1585  
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE-ANV.128/2550

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0586WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: ( 25 ± 3 ) °C

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phraekhong, Bangkok 10260

Relative Humidity: ( 50 ± 20 ) %

Procedure used: Calibration were conducted using in-house calibration procedure CP-H09 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

#### 1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31885	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10240757	TH-0125-21	13 Dec 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Standards and Technology (NIST), The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Somchai Duthwor  
Issue Date: 03 August 2022

Approved Signatory:   
[x] Chakrit Waeawanja  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawuti

เอกสารไม่ควบคุม  
B 0293721



Cert. No.: 22H1585  
Page: 2 of 2

### Result of Calibration:-

Before Adjustment

#### Function:

Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	37	-3.1	1.6
25.0	60.0	55	-5.0	1.8
25.0	80.0	70	-10.0	2.0

### Result of Calibration:-

After Adjustment

#### Function:

Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	76	-4.0	2.0

### Result of Calibration:-

Without Adjustment

#### Function:

Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.04	20.0	-0.04	0.72
30.01	30.0	-0.01	0.72
35.02	34.5	-0.52	0.72
40.02	39.5	-0.52	0.72

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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**MULTI-POINT GAS TEST REPORT**

**Test Date :** Apr 7, 2022

**Equipment :** Gas Analyzer (NO<sub>2</sub>) **Model :** 42C  
**Manufacturer :** Thermo Electron Corporation **Serial Number :** 0517512000

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
 Nitric Oxide (NO) 45.35 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 1007 PPM  
 Cylinder No. : CC159599  
 Expiration Date : Jul 30, 2022

**Dilutor Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	0.50	0.50	0.50
Level 3	40.00%	200.4	0.40	0.20	0.20
Level 4	60.00%	300.5	0.50	0.17	0.17
Level 5	80.00%	400.6	0.60	0.15	0.15
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.30		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by *Prachar y* 24/6/22  
 Approve by *Prachar y* 5 Apr 2022

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

**Test Date :** Apr 7, 2022

**Equipment :** Gas Analyzer (NO<sub>2</sub>) **Model :** 42C  
**Manufacturer :** Thermo Electron Corporation **Serial Number :** 0517512001

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
 Nitric Oxide (NO) 45.35 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 1007 PPM  
 Cylinder No. : CC159599  
 Expiration Date : Jul 30, 2022

**Dilutor Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.9	0.90	0.90	0.90
Level 2	20.00%	100.5	0.50	0.50	0.50
Level 3	40.00%	200.3	0.30	0.15	0.15
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.8	0.80	0.20	0.20
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.40		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by *Prachar y* 24/6/22  
 Approve by *Prachar y* 5 Apr 2022

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

**Test Date :** June 24, 2022

**Equipment :** Gas Analyzer (NO<sub>2</sub>) **Model :** 42i  
**Manufacturer :** Thermo Scientific **Serial Number :** 1201778107

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
 Nitric Oxide (NO) 45.35 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 1007 PPM  
 Cylinder No. : CC159599  
 Expiration Date : Jul 30, 2022

**Dilutor Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.6	1.10	1.10	1.10
Level 2	20.00%	101.5	1.50	1.48	1.48
Level 3	40.00%	201.3	1.30	0.65	0.65
Level 4	60.00%	301.7	1.70	0.56	0.56
Level 5	80.00%	401.5	0.50	0.12	0.12
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.78		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by *Prachar y* 24/6/22  
 Approve by *Prachar y* 24 June 2022

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

**Test Date :** June 29, 2022

**Equipment :** Gas Analyzer (NO<sub>2</sub>) **Model :** 42i  
**Manufacturer :** Thermo Scientific **Serial Number :** 1201778108

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
 Nitric Oxide (NO) 45.35 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 1007 PPM  
 Cylinder No. : CC159599  
 Expiration Date : Jul 30, 2022

**Dilutor Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	1.4	1.40	1.40	1.40
Level 2	20.00%	100.0	0.50	0.50	0.50
Level 3	40.00%	200.0	0.90	0.45	0.45
Level 4	60.00%	300.6	0.60	0.20	0.20
Level 5	80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.54		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by *Prachar y* 29/6/22  
 Approve by *Prachar y* 29 June 2022

เอกสารไม่ควบคุม

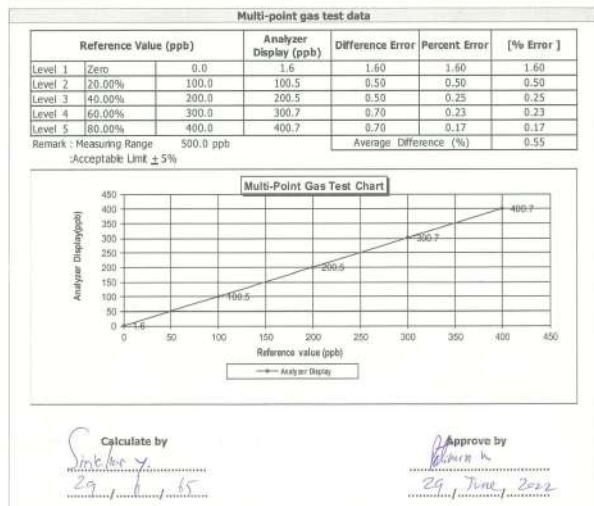
**MULTI-POINT GAS TEST REPORT**

Test Date : June 29, 2022

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778109

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
Nitric Oxide (NO) 45.35 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071



เอกสารไม่ควบคุม

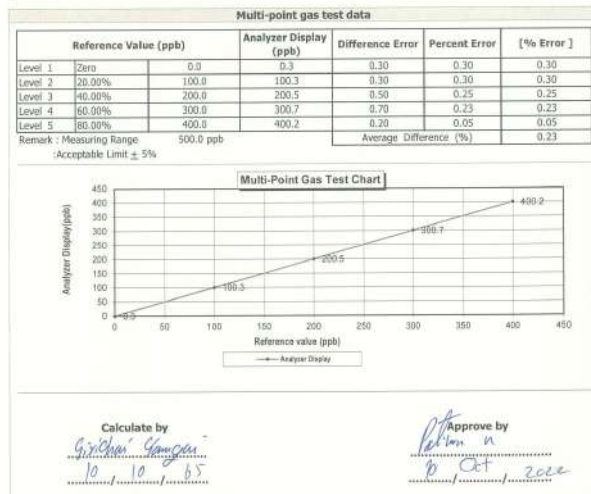
**MULTI-POINT GAS TEST REPORT**

Test Date : Oct 10, 2022

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778110

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071



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**MULTI-POINT GAS TEST REPORT**

Test Date : May 2, 2022

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1200636462

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
Nitric Oxide (NO) 45.35 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.60	0.60	0.60
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.9	0.45	0.45
Level 4	60.00%	300.0	301.7	0.56	0.56
Level 5	80.00%	400.0	400.8	0.20	0.20
Remark : Measuring Range : 500.0 ppb			Average Difference (%) : 0.50		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by : *Sincharin V.*  
2 May 2022

Approve by : *Patumwan K.*  
02 May 2022

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**MULTI-POINT GAS TEST REPORT**

Test Date : June 24, 2022

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CM19050151

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.25 PPM  
Nitric Oxide (NO) 45.35 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	1.3	1.30	1.30
Level 2	20.00%	100.0	101.9	1.90	1.86
Level 3	40.00%	200.0	201.8	1.80	0.89
Level 4	60.00%	300.0	301.7	1.70	0.56
Level 5	80.00%	400.0	400.5	0.12	0.12
Remark : Measuring Range : 500.0 ppb			Average Difference (%) : 0.95		
:Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

Calculate by : *Sincharin V.*  
24 June 2022

Approve by : *Patumwan K.*  
24 June 2022

เอกสารไม่ควบคุม





Airgas Specialty Gases  
Airgas USA, LLC  
2001 2nd Drive  
Durham, NC 27713  
919.417.1000

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Pur Number: F04189E15A01D5 Reference Number: 122-402136167-1  
Cylinder Number: E5C142262 Cylinder Volume: 144 L CF  
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2113 PSIG  
PQVP Number: B22021 Valve Outlet: 500  
Gas Code: CO<sub>2</sub>, NO<sub>2</sub>, AQX, SO<sub>2</sub>, BAI, N Certification Date: Jun 11 2021

Expiration Date: Jun 21, 2024

Our Gas was performed in accordance with EPA Test Method 10.1 for measuring the concentration of Gases in cylinders. Standards used: NIST 1563a, 1563b, 1563c, 1563d, 1563e, 1563f, 1563g, 1563h, 1563i, 1563j, 1563k, 1563l, 1563m, 1563n, 1563o, 1563p, 1563q, 1563r, 1563s, 1563t, 1563u, 1563v, 1563w, 1563x, 1563y, 1563z, 1563aa, 1563ab, 1563ac, 1563ad, 1563ae, 1563af, 1563ag, 1563ah, 1563ai, 1563aj, 1563ak, 1563al, 1563am, 1563an, 1563ao, 1563ap, 1563aq, 1563ar, 1563as, 1563at, 1563au, 1563av, 1563aw, 1563ax, 1563ay, 1563az, 1563ba, 1563bb, 1563bc, 1563bd, 1563be, 1563bf, 1563bg, 1563bh, 1563bi, 1563bj, 1563bk, 1563bl, 1563bm, 1563bn, 1563bo, 1563bp, 1563bq, 1563br, 1563bs, 1563bt, 1563bu, 1563bv, 1563bw, 1563bx, 1563by, 1563bz, 1563ca, 1563cb, 1563cc, 1563cd, 1563ce, 1563cf, 1563cg, 1563ch, 1563ci, 1563cj, 1563ck, 1563cl, 1563cm, 1563cn, 1563co, 1563cp, 1563cq, 1563cr, 1563cs, 1563ct, 1563cu, 1563cv, 1563cw, 1563cx, 1563cy, 1563cz, 1563da, 1563db, 1563dc, 1563dd, 1563de, 1563df, 1563dg, 1563dh, 1563di, 1563dj, 1563dk, 1563dl, 1563dm, 1563dn, 1563do, 1563dp, 1563dq, 1563dr, 1563ds, 1563dt, 1563du, 1563dv, 1563dw, 1563dx, 1563dy, 1563dz, 1563ea, 1563eb, 1563ec, 1563ed, 1563ee, 1563ef, 1563eg, 1563eh, 1563ei, 1563ej, 1563ek, 1563el, 1563em, 1563en, 1563eo, 1563ep, 1563eq, 1563er, 1563es, 1563et, 1563eu, 1563ev, 1563ew, 1563ex, 1563ey, 1563ez, 1563fa, 1563fb, 1563fc, 1563fd, 1563fe, 1563ff, 1563fg, 1563fh, 1563fi, 1563fj, 1563fk, 1563fl, 1563fm, 1563fn, 1563fo, 1563fp, 1563fq, 1563fr, 1563fs, 1563ft, 1563fu, 1563fv, 1563fw, 1563fx, 1563fy, 1563fz, 1563ga, 1563gb, 1563gc, 1563gd, 1563ge, 1563gf, 1563gg, 1563gh, 1563gi, 1563gj, 1563gk, 1563gl, 1563gm, 1563gn, 1563go, 1563gp, 1563gq, 1563gr, 1563gs, 1563gt, 1563gu, 1563gv, 1563gw, 1563gx, 1563gy, 1563gz, 1563ha, 1563hb, 1563hc, 1563hd, 1563he, 1563hf, 1563hg, 1563hi, 1563hj, 1563hk, 1563hl, 1563hm, 1563hn, 1563ho, 1563hp, 1563hq, 1563hr, 1563hs, 1563ht, 1563hu, 1563hv, 1563hw, 1563hx, 1563hy, 1563hz, 1563ia, 1563ib, 1563ic, 1563id, 1563ie, 1563if, 1563ig, 1563ih, 1563ii, 1563ij, 1563ik, 1563il, 1563im, 1563in, 1563io, 1563ip, 1563iq, 1563ir, 1563is, 1563it, 1563iu, 1563iv, 1563iw, 1563ix, 1563iy, 1563iz, 1563ja, 1563jb, 1563jc, 1563jd, 1563je, 1563jf, 1563jg, 1563jh, 1563ji, 1563jj, 1563jk, 1563jl, 1563jm, 1563jn, 1563jo, 1563jp, 1563jq, 1563jr, 1563js, 1563jt, 1563ju, 1563jv, 1563jw, 1563jx, 1563jy, 1563jz, 1563ka, 1563kb, 1563kc, 1563kd, 1563ke, 1563kf, 1563kg, 1563kh, 1563ki, 1563kj, 1563kk, 1563kl, 1563km, 1563kn, 1563ko, 1563kp, 1563kq, 1563kr, 1563ks, 1563kt, 1563ku, 1563kv, 1563kw, 1563kx, 1563ky, 1563kz, 1563la, 1563lb, 1563lc, 1563ld, 1563le, 1563lf, 1563lg, 1563lh, 1563li, 1563lj, 1563lk, 1563ll, 1563lm, 1563ln, 1563lo, 1563lp, 1563lq, 1563lr, 1563ls, 1563lt, 1563lu, 1563lv, 1563lw, 1563lx, 1563ly, 1563lz, 1563ma, 1563mb, 1563mc, 1563md, 1563me, 1563mf, 1563mg, 1563mh, 1563mi, 1563mj, 1563mk, 1563ml, 1563mm, 1563mn, 1563mo, 1563mp, 1563mq, 1563mr, 1563ms, 1563mt, 1563mu, 1563mv, 1563mw, 1563mx, 1563my, 1563mz, 1563na, 1563nb, 1563nc, 1563nd, 1563ne, 1563nf, 1563ng, 1563nh, 1563ni, 1563nj, 1563nk, 1563nl, 1563nm, 1563nn, 1563no, 1563np, 1563nq, 1563nr, 1563ns, 1563nt, 1563nu, 1563nv, 1563nw, 1563nx, 1563ny, 1563nz, 1563oa, 1563ob, 1563oc, 1563od, 1563oe, 1563of, 1563og, 1563oh, 1563oi, 1563oj, 1563ok, 1563ol, 1563om, 1563on, 1563oo, 1563op, 1563oq, 1563or, 1563os, 1563ot, 1563ou, 1563ov, 1563ow, 1563ox, 1563oy, 1563oz, 1563pa, 1563pb, 1563pc, 1563pd, 1563pe, 1563pf, 1563pg, 1563ph, 1563pi, 1563pj, 1563pk, 1563pl, 1563pm, 1563pn, 1563po, 1563pp, 1563pq, 1563pr, 1563ps, 1563pt, 1563pu, 1563pv, 1563pw, 1563px, 1563py, 1563pz, 1563qa, 1563qb, 1563qc, 1563qd, 1563qe, 1563qf, 1563qg, 1563qh, 1563qi, 1563qj, 1563qk, 1563ql, 1563qm, 1563qn, 1563qo, 1563qp, 1563qq, 1563qr, 1563qs, 1563qt, 1563qu, 1563qv, 1563qw, 1563qx, 1563qy, 1563qz, 1563ra, 1563rb, 1563rc, 1563rd, 1563re, 1563rf, 1563rg, 1563rh, 1563ri, 1563rj, 1563rk, 1563rl, 1563rm, 1563rn, 1563ro, 1563rp, 1563rq, 1563rr, 1563rs, 1563rt, 1563ru, 1563rv, 1563rw, 1563rx, 1563ry, 1563rz, 1563sa, 1563sb, 1563sc, 1563sd, 1563se, 1563sf, 1563sg, 1563sh, 1563si, 1563sj, 1563sk, 1563sl, 1563sm, 1563sn, 1563so, 1563sp, 1563sq, 1563sr, 1563ss, 1563st, 1563su, 1563sv, 1563sw, 1563sx, 1563sy, 1563sz, 1563ta, 1563tb, 1563tc, 1563td, 1563te, 1563tf, 1563tg, 1563th, 1563ti, 1563tj, 1563tk, 1563tl, 1563tm, 1563tn, 1563to, 1563tp, 1563tq, 1563tr, 1563ts, 1563tt, 1563tu, 1563tv, 1563tw, 1563tx, 1563ty, 1563tz, 1563ua, 1563ub, 1563uc, 1563ud, 1563ue, 1563uf, 1563ug, 1563uh, 1563ui, 1563uj, 1563uk, 1563ul, 1563um, 1563un, 1563uo, 1563up, 1563uq, 1563ur, 1563us, 1563ut, 1563uu, 1563uv, 1563uw, 1563ux, 1563uy, 1563uz, 1563va, 1563vb, 1563vc, 1563vd, 1563ve, 1563vf, 1563vg, 1563vh, 1563vi, 1563vj, 1563vk, 1563vl, 1563vm, 1563vn, 1563vo, 1563vp, 1563vq, 1563vr, 1563vs, 1563vt, 1563vu, 1563vv, 1563vw, 1563vx, 1563vy, 1563vz, 1563wa, 1563wb, 1563wc, 1563wd, 1563we, 1563wf, 1563wg, 1563wh, 1563wi, 1563wj, 1563wk, 1563wl, 1563wm, 1563wn, 1563wo, 1563wp, 1563wq, 1563wr, 1563ws, 1563wt, 1563wu, 1563wv, 1563ww, 1563wx, 1563wy, 1563wz, 1563xa, 1563xb, 1563xc, 1563xd, 1563xe, 1563xf, 1563xg, 1563xh, 1563xi, 1563xj, 1563xk, 1563xl, 1563xm, 1563xn, 1563xo, 1563xp, 1563xq, 1563xr, 1563xs, 1563xt, 1563xu, 1563xv, 1563xw, 1563xx, 1563xy, 1563xz, 1563ya, 1563yb, 1563yc, 1563yd, 1563ye, 1563yf, 1563yg, 1563yh, 1563yi, 1563yj, 1563yk, 1563yl, 1563ym, 1563yn, 1563yo, 1563yp, 1563yq, 1563yr, 1563ys, 1563yt, 1563yu, 1563yv, 1563yw, 1563yx, 1563yy, 1563yz, 1563za, 1563zb, 1563zc, 1563zd, 1563ze, 1563zf, 1563zg, 1563zh, 1563zi, 1563zj, 1563zk, 1563zl, 1563zm, 1563zn, 1563zo, 1563zp, 1563zq, 1563zr, 1563zs, 1563zt, 1563zu, 1563zv, 1563zw, 1563zx, 1563zy, 1563zz

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NO <sub>2</sub>	44.75 PPM	44.75 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/27/2021
NITROGEN DIOXIDE	45.35 PPM	45.35 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/27/2021
METHANE	45.35 PPM	45.35 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/27/2021
CARBON MONOXIDE	1007 PPM	1007 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021, 08/27/2021
NITROGEN	99.99%	99.99%	G1	+/- 0.7% NIST Traceable	08/14/2021, 08/27/2021

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NITROGEN	20081125	C0730069	99.99% NITROGEN	+/- 1.0%	Feb 20, 2025
METHANE	12705	0080625	99.99% METHANE	+/- 2.0%	Feb 20, 2020
NITROGEN DIOXIDE	40123555/02	C000081	44.75 PPM NITROGEN DIOXIDE	+/- 2.0%	Feb 16, 2023
METHANE	0611104	C043277	45.35 PPM METHANE	+/- 0.8%	Jan 17, 2022
NITROGEN	0602115	C043277	99.99% NITROGEN	+/- 0.8%	Jan 17, 2022

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nicolet 8700 AHR001333 CO	FTIR	Jan 30, 2021
Nicolet 8700 AHR001333 NO <sub>2</sub>	FTIR	Jan 30, 2021
Nicolet 8700 AHR001333 CH <sub>4</sub>	FTIR	Jan 30, 2021
Nicolet 8700 AHR001333 CO	FTIR	Jan 30, 2021

Trid Data Available Upon Request

NOTES: 1. #52100200  
GROSS WT: 23.40 kg  
NET WT: 4.75 kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Tel: 0 2763 2828 Fax: 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

## MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

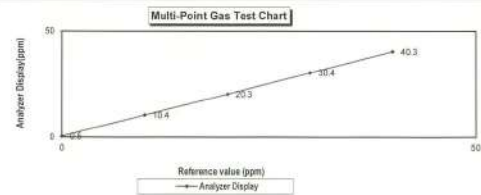
Equipment : Gas Analyzer (CO) Model : 48  
Manufacturer : Thermo Scientific Serial Number : CM08140003

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO <sub>2</sub> ) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH <sub>4</sub> ) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CCI59599	
Expiration Date : Jul 30, 2022	

## Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	10.4	0.4	3.8
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.4	0.4	1.3
Level 5 80.00%	40.0	40.3	0.3	0.7
Remark : Measuring Range	50.0 ppm		Average Difference (%)	1.58

Acceptable Limit  $\pm 5\%$



Calculate by  
Sukhum V.  
26/4/22

Approve by  
Pichan N.  
27 Apr 2022

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เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.  
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Tel: 0 2763 2828 Fax: 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

## MULTI-POINT GAS TEST REPORT

Test Date : Apr 29, 2022

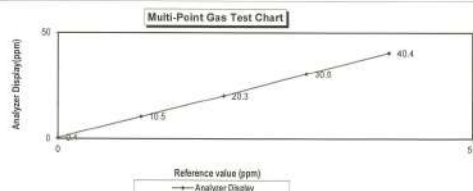
Equipment : Gas Analyzer (CO) Model : 48  
Manufacturer : Thermo Scientific Serial Number : 1180540068

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO <sub>2</sub> ) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH <sub>4</sub> ) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CCI59599	
Expiration Date : Jul 30, 2022	

## Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.4	0.4	0.4
Level 2 20.00%	10.0	10.5	0.5	4.8
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.4	0.4	1.0
Remark : Measuring Range	50.0 ppm		Average Difference (%)	1.92

Acceptable Limit  $\pm 5\%$



Calculate by  
Sukhum V.  
29/4/22

Approve by  
Pichan N.  
29 Apr 2022

Page 1 of 1

เอกสารไม่ควบคุม

## MULTI-POINT GAS TEST REPORT

Test Date : June 17, 2022

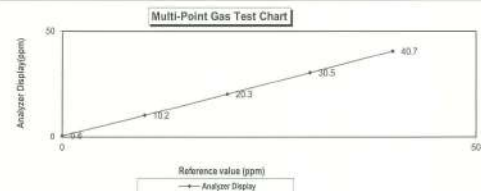
Equipment : Gas Analyzer (CO) Model : 48  
Manufacturer : Thermo Scientific Serial Number : 1201497730

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO <sub>2</sub> ) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH <sub>4</sub> ) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CCI59599	
Expiration Date : Jul 30, 2022	

## Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.6	0.6	0.6
Level 2 20.00%	10.0	10.2	0.2	2.0
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.5	0.5	1.6
Level 5 80.00%	40.0	40.7	0.7	1.7
Remark : Measuring Range	50.0 ppm		Average Difference (%)	1.48

Acceptable Limit  $\pm 5\%$



Calculate by  
Sukhum V.  
17/6/22

Approve by  
Pichan N.  
17 June 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Sep 12, 2022

Equipment : Gas Analyzer (CO) Model : 48i  
 Manufacturer : Thermo Scientific Serial Number : 1201497732

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
 Nitric Oxide (NO) 45.94 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 984.8 PPM  
 Cylinder No.: EB0143262  
 Expiration Date : Jun 20, 2024

**Diluter Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	0.5	4.8	4.8
Level 3	40.00%	20.0	0.7	3.4	3.4
Level 4	60.00%	30.0	0.6	2.0	2.0
Level 5	80.00%	40.0	0.7	1.7	1.7

Remark : Measuring Range 50.0 ppm  
 Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by *Sirichai Sangsri*  
 12 Sep 2022

Approve by *Polkorn W*  
 12 Sep 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Sep 12, 2022

Equipment : Gas Analyzer (CO) Model : 48i  
 Manufacturer : Thermo Scientific Serial Number : 1201497732

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
 Nitric Oxide (NO) 45.94 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 984.8 PPM  
 Cylinder No.: EB0143262  
 Expiration Date : Jun 20, 2024

**Diluter Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.8	0.8	0.8
Level 2	20.00%	10.0	0.7	6.5	6.5
Level 3	40.00%	20.0	0.5	2.4	2.4
Level 4	60.00%	30.0	1.5	4.8	4.8
Level 5	80.00%	40.0	0.8	2.0	2.0

Remark : Measuring Range 50.0 ppm  
 Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by *Sirichai Sangsri*  
 12 Sep 2022

Approve by *Polkorn W*  
 12 Sep 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Oct 6, 2022

Equipment : Gas Analyzer (CO) Model : 48i  
 Manufacturer : Thermo Scientific Serial Number : 1201778117

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
 Nitric Oxide (NO) 45.94 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 984.8 PPM  
 Cylinder No.: EB0143262  
 Expiration Date : Jun 20, 2024

**Diluter Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	1.8	1.8	1.8
Level 2	20.00%	10.0	0.7	6.5	6.5
Level 3	40.00%	20.0	1.4	6.5	6.5
Level 4	60.00%	30.0	0.5	1.6	1.6
Level 5	80.00%	40.0	1.2	2.9	2.9

Remark : Measuring Range 50.0 ppm  
 Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by *Sirichai Sangsri*  
 10 Oct 2022

Approve by *Polkorn W*  
 10 Oct 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Oct 6, 2022

Equipment : Gas Analyzer (CO) Model : 48i  
 Manufacturer : Thermo Scientific Serial Number : 1201778118

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
 Nitric Oxide (NO) 45.94 PPM  
 Methane (CH<sub>4</sub>) - PPM  
 Carbon Monoxide (CO) 984.8 PPM  
 Cylinder No.: EB0143262  
 Expiration Date : Jun 20, 2024

**Diluter Detail**  
 Manufacturer : Thermo Scientific  
 Model : 146i  
 Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	0.5	4.8	4.8
Level 3	40.00%	20.0	0.8	3.8	3.8
Level 4	60.00%	30.0	0.5	1.6	1.6
Level 5	80.00%	40.0	0.9	2.2	2.2

Remark : Measuring Range 50.0 ppm  
 Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by *Sirichai Sangsri*  
 10 Oct 2022

Approve by *Polkorn W*  
 10 Oct 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : June 15, 2022

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1201778119

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM  
Nitric Oxide (NO) 45.35 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CCI195999  
Expiration Date : Jul 30, 2022

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 1451  
Serial Number : 1180540071

**Multi-point gas test data**

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	0.5	4.8	4.8
Level 3 40.00%	20.0	0.4	2.0	2.0
Level 4 60.00%	30.0	0.3	1.0	1.0
Level 5 80.00%	40.0	0.4	1.0	1.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.84	

Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by  
Srichan Y.  
9 June 2022

Approve by  
16 June 2022

Page 1 of 1

เอกสารไม่ควบคุม



Airgas Specialty Gases  
Airgas USA, LLC  
2001 Second Drive  
Durham, NC 27713  
Airgas Inc.

**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA Protocol**

Purity Number: F041W9E1EAD105 Reference Number: 122-402136167-1  
Cylinder Number: EBC142362 Cylinder Volume: 144 L CF  
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2113 PSIG  
PQSP Number: 822021 Value Outlet: 500  
Gas Code: CO, NO, AQX, SO2, BAI, N Certification Date: Jun 21 2021  
Expiration Date: Jun 21, 2024

On-line use performed - Laboratory and Purity Test Report for use as a Certificate of Analysis. This report is for informational purposes only. It is not a guarantee of purity. The purity of the gas is determined by the results of the tests performed. The results of the tests are shown in the table below. The results of the tests are shown in the table below. The results of the tests are shown in the table below.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.35 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 08/16/2021
NO	45.00 PPM	45.35 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 08/16/2021
SO <sub>2</sub>	44.75 PPM	44.75 PPM	G1	$\pm 1.0\%$ NIST Traceable	08/14/2021, 08/16/2021
CH <sub>4</sub>	1007 PPM	1007 PPM	G1	$\pm 0.7\%$ NIST Traceable	08/14/2021, 08/16/2021

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NOX	20281120	C0750068	45.00 PPM	$\pm 1.4\%$	Feb 20, 2025
NO	20281120	C0750068	45.00 PPM	$\pm 1.4\%$	Feb 20, 2025
SO <sub>2</sub>	20281120	C0750068	44.75 PPM	$\pm 1.0\%$	Feb 20, 2025
CH <sub>4</sub>	20281120	C0750068	1007 PPM	$\pm 0.7\%$	Feb 20, 2025

Instrument/Make/Model	Analytical Principle	Last Multiple Calibration
Model 481 CO Analyzer	FIR	Aug 30, 2021
Model 481 NO Analyzer	FIR	Aug 30, 2021
Model 481 SO <sub>2</sub> Analyzer	FIR	Aug 30, 2021
Model 481 CH <sub>4</sub> Analyzer	FIR	Aug 30, 2021

Titration Data Available Upon Request  
NOTES: CO #521002807  
GROSS WT: 23.40 kg  
NET WT: 4.75 kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
Manufacturer : HORIBA Serial Number : VJUPVTC21

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) - PPM  
Nitric Oxide (NO) - PPM  
Methane (CH<sub>4</sub>) 39.8 PPM  
Carbon Monoxide (CO) - PPM  
Cylinder No. : D824432  
Expiration Date : Aug 4, 2028

**Dilutor Detail**  
Manufacturer :  
Model :  
Serial Number :

**Multi-point gas test data**

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1 Zero	0.00	0.51	0.51	0.51
Level 2 80.00%	40.00	-0.40	-1.01	1.01
Remark : Measuring Range	50.00 ppm	Average Difference (%)	0.76	

Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by  
Srichan Y.  
9 Mar 2022

Approve by  
9 Mar 2022

Page 1 of 1

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
Manufacturer : HORIBA Serial Number : PDREXQF7

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) - PPM  
Nitric Oxide (NO) - PPM  
Methane (CH<sub>4</sub>) 39.8 PPM  
Carbon Monoxide (CO) - PPM  
Cylinder No. : D824432  
Expiration Date : Aug 4, 2028

**Dilutor Detail**  
Manufacturer :  
Model :  
Serial Number :

**Multi-point gas test data**

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1 Zero	0.00	1.44	1.44	1.44
Level 2 80.00%	40.00	-1.30	-3.36	3.36
Remark : Measuring Range	50.00 ppm	Average Difference (%)	2.40	

Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**

Calculate by  
Srichan Y.  
9 Mar 2022

Approve by  
9 Mar 2022

Page 1 of 1

เอกสารไม่ควบคุม



**MULTI-POINT GAS TEST REPORT**

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
 Manufacturer : HORIBA Serial Number : SSGEYB3

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) : - PPM  
 Nitric Oxide (NO) : - PPM  
 Methane (CH<sub>4</sub>) : 39.8 PPM  
 Carbon Monoxide (CO) : - PPM  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Dilutor Detail**

Manufacturer :  
 Model :  
 Serial Number :

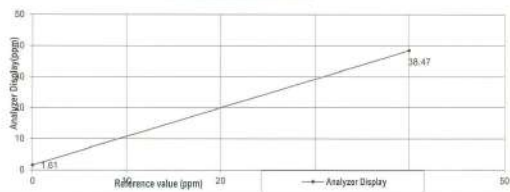
**Multi-point gas test data**

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.61	1.61	1.61
Level 2	80.00%	40.00	-1.53	-3.98	3.98

Remark : Measuring Range 50.00 ppm  
 (Acceptable Limit  $\pm 5\%$ )

Average Difference (%) 2.79

**Multi-Point Gas Test Chart**



Calculate by  
 Srisakul Y.  
 9, 3, 22

Approve by  
 Polkorn N.  
 9, Mar, 2022

**MULTI-POINT GAS TEST REPORT**

Test Date : Mar 21, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
 Manufacturer : HORIBA Serial Number : VV2FY3R3

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) : - PPM  
 Nitric Oxide (NO) : - PPM  
 Methane (CH<sub>4</sub>) : 39.8 PPM  
 Carbon Monoxide (CO) : - PPM  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Dilutor Detail**

Manufacturer :  
 Model :  
 Serial Number :

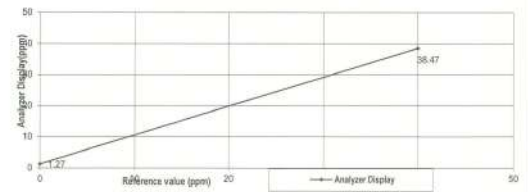
**Multi-point gas test data**

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.27	1.27	1.27
Level 2	80.00%	40.00	-1.53	-3.98	3.98

Remark : Measuring Range 50.00 ppm  
 (Acceptable Limit  $\pm 5\%$ )

Average Difference (%) 2.62

**Multi-Point Gas Test Chart**



Calculate by  
 Srisakul Y.  
 21, 3, 22

Approve by  
 Polkorn N.  
 21, Mar, 2022

**MULTI-POINT GAS TEST REPORT**

Test Date : Apr 4, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
 Manufacturer : HORIBA Serial Number : T4FG19AN

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) : - PPM  
 Nitric Oxide (NO) : - PPM  
 Methane (CH<sub>4</sub>) : 39.8 PPM  
 Carbon Monoxide (CO) : - PPM  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Dilutor Detail**

Manufacturer :  
 Model :  
 Serial Number :

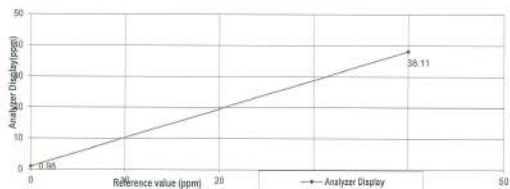
**Multi-point gas test data**

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.98	0.98	0.98	0.98
Level 2	80.00%	38.11	-1.89	-4.96	4.96

Remark : Measuring Range 50.00 ppm  
 (Acceptable Limit  $\pm 5\%$ )

Average Difference (%) 2.97

**Multi-Point Gas Test Chart**



Calculate by  
 Srisakul Y.  
 4, 04, 22

Approve by  
 Polkorn N.  
 4, Apr, 2022

**MULTI-POINT GAS TEST REPORT**

Test Date : Mar 21, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
 Manufacturer : HORIBA Serial Number : HAMEHJSM

**Standard Gas Concentration**  
 Sulphur Dioxide (SO<sub>2</sub>) : - PPM  
 Nitric Oxide (NO) : - PPM  
 Methane (CH<sub>4</sub>) : 39.8 PPM  
 Carbon Monoxide (CO) : - PPM  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Dilutor Detail**

Manufacturer :  
 Model :  
 Serial Number :

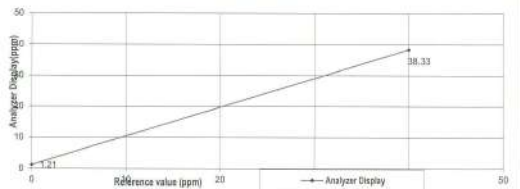
**Multi-point gas test data**

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.21	1.21	1.21
Level 2	80.00%	40.00	-1.67	-4.36	4.36

Remark : Measuring Range 50.00 ppm  
 (Acceptable Limit  $\pm 5\%$ )

Average Difference (%) 2.78

**Multi-Point Gas Test Chart**



Calculate by  
 Srisakul Y.  
 21, 3, 22

Approve by  
 Polkorn N.  
 21, Mar, 2022



THE LINDE GROUP

Certificate Of Analysis

Special Gases Mixture

Customer Details

Name:

United Analyt & Engineering Co., Ltd.

Address:

330 Udomrak 41, Sukhumvit Rd., Bang Chak, Khut Phra Khrueng, Bangkok 10260

Customer Tag No.:

Certificate Details

Number:

3384/20

Date of Issue:

4-Aug-2020

Expiry date:

4-Aug-2028

Material Details

Material Code:

400400-AL-34

Cylinder No.:

B824132

Production Order:

90161442

Filling pressure:

137.0 bar

Valve:

CGA 370 BRASS

Gas content:

6.60 M<sup>3</sup>

Cylinder Owner:

LINDE

Cylinder Material:

Aluminum

Valinder Size:

38 L

Laboratory Report

Component

Merthane

Normal Concentration

40.0 ppm

Analysis Result<sup>1</sup>

39.8 ppm

Uncertainty<sup>2</sup>

± 1% relative

Method of Analysis<sup>3</sup>

(A) I-PB 332

Assay Date

4-Aug-2020

Reference Standard

Merthane in Nitrogen

Cylinder number

25599950

Concentration

49.29 ± 0.39 ppm

Expiry date

3-Dec-2020

Analytical Instruments used in Assay

Instrument/Make/Model

FIR Spectrometer Model 558

Analytical Principle

FIR-CH4

Last Independent Calibration

4-Aug-2020

Recommend usage condition

Minimum utilization

5% of actual content or before expiry date whichever comes first.

Storage condition

Keep in well ventilation and secure area.

Comments

When recording, please quote the material number

Note:

1. All results reported in this report are on analysis basis, unless otherwise specified. The value of the standard has been determined in accordance with the EN 50469 standard (the value is 10.00 for the above and standard of oxygen calibration standard using air as reference).

2. The reported expanded uncertainty is based on a standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95%.

3. The measurement of this material is made by the following the reference gas standard which is available in our lab and standard of this is also on expanded calibration certificate.

4. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analysis, (3) Electrochemical Oxygen Analysis, (4) Electrochemical Hydrogen Analysis, (5) Total Hydrogen Analysis, (6) Other - Specified

Page 1 of 1

Sukanya Panyapornchot

Signature for and on behalf of Linde (Thailand) Co., Ltd.

PH 02/2020

Linde (Thailand) Public Company Limited

12 Floor, Bangkok Tower A, 171 Moo 14, Bangna-Trad Road, Bangna Suburb, Bangkok 10700, Thailand

Telephone: (66) 02-076-479-41 Fax: (66) 02-076-479-42

Telex: (66) 02-076-479-41

SCARLET TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

Client:

Envir Service Co., Ltd.

Serial No.:

2205070008

Calibration Date:

2022/9/14

Calibration Expiry Date:

2023/9/13

The Result of Calibration

Measured Value (m/s)

Actual Value (m/s)

Deviation

Tolerance

Result

0.9

1.0

0.1

0.9-1.1

Pass

1.9

2.0

0.1

1.8-2.2

Pass

5.0

5.0

0.0

4.7-5.3

Pass

7.0

7.0

0.0

6.0-8.0

Pass

10.1

10.0

0.1

9.5-10.5

Pass

19.6

20.0

0.4

19.0-21.0

Pass

Wind Direction

Measured Value

Actual Value

Deviation

Tolerance

Result

45°

45°

0

42-48

Pass

135°

135°

1

132-138

Pass

225°

225°

2

222-228

Pass

315°

315°

1

312-318

Pass

359°

0°

1

357-3

Pass

Inspection Room Temp

Actual Value

Deviation

Tolerance

Result

22.5°C

22.5°C

0.0

21.5-23.5

Pass

Atmospheric Pressure Inspection

Actual Value

Deviation

Tolerance

Result

1005

1005

0

1001-1019

Pass

Environment conditions :

Air temperature:

22 °C

Relative humidity:

55 %

Static pressure:

102.2 kPa

Performed by:

Certified by Head of Engineering

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan

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SCARLET TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

Client:

Envir Service Co., Ltd.

Serial No.:

2205070105

Calibration Date:

2022/9/14

Calibration Expiry Date:

2023/9/13

The Result of Calibration

Measured Value (m/s)

Actual Value (m/s)

Deviation

Tolerance

Result

1.1

1.0

0.1

0.9-1.1

Pass

2.0

2.0

0.0

1.8-2.2

Pass

5.1

5.0

0.1

4.7-5.3

Pass

7.0

7.0

0.0

6.0-8.0

Pass

10.1

10.0

0.1

9.5-10.5

Pass

19.7

20.0

0.3

19.0-21.0

Pass

Wind Direction

Measured Value

Actual Value

Deviation

Tolerance

Result

45°

45°

1

42-48

Pass

135°

135°

0

132-138

Pass

225°

225°

1

222-228

Pass

315°

315°

1

312-318

Pass

359°

0°

1

357-3

Pass

Inspection Room Temp

Actual Value

Deviation

Tolerance

Result

22.6°C

22.5°C

0.1

21.5-23.5

Pass

Atmospheric Pressure Inspection

Actual Value

Deviation

Tolerance

Result

1005

1005

0

1001-1019

Pass

Environment conditions :

Air temperature:

22 °C

Relative humidity:

55 %

Static pressure:

102.2 kPa

Performed by:

Certified by Head of Engineering

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SCARLET TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

Client:

Envir Service Co., Ltd.

Serial No.:

2205070106

Calibration Date:

2022/9/14

Calibration Expiry Date:

2023/9/13

The Result of Calibration

Measured Value (m/s)

Actual Value (m/s)

Deviation

Tolerance

Result

1.0

1.0

0.0

0.9-1.1

Pass

1.9

2.0

0.1

1.8-2.2

Pass

5.0

5.0

0.0

4.7-5.3

Pass

7.1

7.0

0.1

6.0-8.0

Pass

10.1

10.0

0.1

9.5-10.5

Pass

19.6

20.0

0.4

19.0-21.0

Pass

Wind Direction

Measured Value

Actual Value

Deviation

Tolerance

Result

45°

45°

0

42-48

Pass

135°

135°

1

132-138

Pass

225°

225°

0

222-228

Pass

315°

315°

1

312-318

Pass

359°

0°

1

357-3

Pass

Inspection Room Temp

Actual Value

Deviation

Tolerance

Result

22.4°C

22.5°C

0.3

21.5-23.5

Pass

Atmospheric Pressure Inspection

Actual Value

Deviation

Tolerance

Result

1005

1005

0

1001-1019

Pass

Environment conditions :

Air temperature:

22 °C

Relative humidity:

55 %

Static pressure:

102.2 kPa


Performed by:

Certified by Head of Engineering

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SCARLET TECH

## Certificate of Calibration

### WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

**Client:** Envir Service Co., Ltd.  
**Serial No.:** 2205DT0113  
**Calibration Date:** 2022/9/14  
**Calibration Expiry Date:** 2023/9/13

#### The Result of Calibration


Velocity				
Measured Value(m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9-1.1	Pass
2.1	2.0	0.1	1.9-2.2	Pass
5.1	5.0	0.1	4.7-5.3	Pass
7.0	7.0	0.0	6.0-8.0	Pass
10.2	10.0	0.2	9.5-10.5	Pass
19.8	20.0	0.2	19.0-21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45°	0	42-48	Pass
135°	135°	1	132-138	Pass
225°	225°	2	222-228	Pass
315°	315°	1	312-318	Pass
358°	0°	2	357-3	Pass

Inspection Room Temp				
Actual Value	Deviation	Tolerance	Result	
22.5°C	0.0	21.5-23.5	Pass	

Atmospheric Pressure Inspection				
Actual Value	Deviation	Tolerance	Result	
1005	0	1001-1019	Pass	

**Environment conditions :**  
 Air temperature: 22 °C  
 Relative humidity: 55 %  
 Static pressure: 102.2 kPa

Performed by:   
 Certified by Head of Engineering Department

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SCARLET TECH

## Certificate of Calibration

### WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

**Client:** Envir Service Co., Ltd.  
**Serial No.:** 2205DT0114  
**Calibration Date:** 2022/9/14  
**Calibration Expiry Date:** 2023/9/13

#### The Result of Calibration

Velocity				
Measured Value(m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9-1.1	Pass
1.9	2.0	0.1	1.8-2.2	Pass
5.1	5.0	0.1	4.7-5.3	Pass
7.0	7.0	0.0	6.0-8.0	Pass
10.1	10.0	0.1	9.5-10.5	Pass
19.6	20.0	0.4	19.0-21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45°	0	42-48	Pass
136°	135°	1	132-138	Pass
227°	225°	2	222-228	Pass
316°	315°	1	312-318	Pass
358°	0°	2	357-3	Pass

Inspection Room Temp				
Actual Value	Deviation	Tolerance	Result	
22.5°C	0.0	21.5-23.5	Pass	


Atmospheric Pressure Inspection				
Actual Value	Deviation	Tolerance	Result	
1005	0	1001-1019	Pass	

**Environment conditions :**  
 Air temperature: 22 °C  
 Relative humidity: 55 %  
 Static pressure: 102.2 kPa

Performed by:   
 Certified by Head of Engineering Department

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SCARLET TECH

## Certificate of Calibration

### WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

**Client:** Envir Service Co., Ltd.  
**Serial No.:** 2205DT0116  
**Calibration Date:** 2022/9/14  
**Calibration Expiry Date:** 2023/9/13

#### The Result of Calibration


Velocity				
Measured Value(m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9-1.1	Pass
2.1	2.0	0.1	1.8-2.2	Pass
5.0	5.0	0.0	4.7-5.3	Pass
7.1	7.0	0.1	6.0-8.0	Pass
10.2	10.0	0.2	9.5-10.5	Pass
19.9	20.0	0.1	19.0-21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45°	0	42-48	Pass
134°	135°	1	132-138	Pass
225°	225°	0	222-228	Pass
315°	315°	1	312-318	Pass
358°	0°	2	357-3	Pass

Inspection Room Temp				
Actual Value	Deviation	Tolerance	Result	
22.5°C	0.0	21.5-23.5	Pass	

Atmospheric Pressure Inspection				
Actual Value	Deviation	Tolerance	Result	
1005	0	1001-1019	Pass	

**Environment conditions :**  
 Air temperature: 22 °C  
 Relative humidity: 55 %  
 Static pressure: 102.2 kPa

Performed by:   
 Certified by Head of Engineering Department

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## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
 Date of Issue : 7 April, 2022 Certification No. 148/22  
 Page : 1 of 6

**Object :** เครื่องมือตรวจวัดอุตุนิยมวิทยา

**Manufacturer :** LSI

**Type :** Data Logger E-LOG 305 wind speed and wind direction DNA 827  
 Thermoigmeters DMA875 Barometer DQA 801

**Mfg Code :** Data Logger 19040405 wind speed and wind direction 19050234  
 Thermoigmeters 19050006 Barometer 19040218


**Customer :** United Analyst and Engineering Consultant Co.,Ltd.  
 81 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Prakanong, Bangkok 10260.

**Calibration Condition :** Temperature 25.1 °C Barometric Pressure 1014.1 hPa

**NATIONAL STANDARD WIND TUNNEL :** Thermal Anemometer 642 S/N 91563  
 : HOOK GAGE NO 1425 : Wind Aloft Plotting Board  
 : N.I.S.T. Test Reference Number 731/241460  
 : Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
 : Serial Number 110730029 (sensor 1206290586)  
 : JAPAN QUALITY ASSURANCE ORGANIZATION

**STANDARD THERMOMETER :** Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94  
 : Isetto, Isetto 645 Serial No. 02948007 : Thermoschneider No.918802

**STANDARD BAROMETER :** Digital Barometer Vaisala Type PTB330 No. 371920015  
 : Digital Barometer Vaisala Type PTB330 No. 84320001

Calibrated by:  Signed:  (Authorised Signatory)  
 Mr. Watcharapol Subwat Mr. Pibool Pibumut  
 Mechanical Engineer Sub-Standard Instrument

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## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Certification No. 148/22

7 April, 2022

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H <sub>2</sub> O	inches H <sub>2</sub> O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	-
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.7	0.30
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.7	0.32
11.02	-	-	-	10.8	0.22
13.01	-	-	-	12.7	0.31
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.7	0.32
20.02	-	-	-	19.8	0.22

Wind Aloft Plotting Board	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by: Handarap  
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 7 April, 2022

Certification No. 149/22

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : LSI

Type : Data Logger : E-LOG 305 wind speed and wind direction DNA 821

Thermoisigrometers DMA875 Barometer DQA 801

Mfg Code : Data Logger : 20020300 wind speed and wind direction 20010220

Thermoisigrometers 19100290 Barometer 20030066

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1014.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848097 : Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PTB330 No. K0326001

Calibrated by: Handarap

Signed: Mr. Pirod Promut

(Authorized Signatory)

Mr. Watcharapol Subwat

Mr. Pirod Promut

Mechanical Engineer

Sub-Standard Instrument

เอกสารไม่ควบคุม



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Certification No. 149/22

7 April, 2022

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H <sub>2</sub> O	inches H <sub>2</sub> O	m/sec	m/sec	m/sec
1.00	-	-	-	1.1	-0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.7	0.30
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.7	0.32
11.02	-	-	-	10.9	0.12
13.01	-	-	-	12.7	0.31
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.7	0.32
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by: Handarap  
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

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INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUNTANAKORN 11 TAMBON BANG KAE  
AMPHOE BANG PHU, SAMUT PRAKAN PROVINCE 10140 THAILAND  
TEL: 0909-2119-7000-1 FAX: 0909-2119-7140



### Certificate of Calibration

#### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 22-ACT-524

Request No : Req-2022-1546

#### Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : SVANTEK

Range : 94 , 114 dB / 1000 Hz

Model : SV 35

Instrument Status : Used

Serial Number : 44783

ID : UAE-EFM.019/2559

#### Calibration Environment and Details

Temperature : ( 23 ± 2 °C )

Humidity : ( 50 ± 20 %RH )

Barometric Pressure : ( 1013 ± 0.0 kPa )

Received Date : 9 August 2022

Calibration Date : 19 August 2022

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2023
THD Multimeter	2915	1047765	NIMT	2 February 2023

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

#### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By : Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : Mr. Paitit Muthavorn  
Calibration Engineer Supervisor

Issue Date : 19 August 2022

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Request No : Req-2022-1546

Sound pressure level

#### Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( $\pm$ dB)	Acceptance limit Class 1 ( $\pm$ dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.23	0.23	-	-	0.11	0.25
114 dB / 1000 Hz	114.23	0.23	-	-	0.11	0.25

## Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( ± %)	Acceptance limit Class I ( ± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70

## Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class I (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.05	-	0.40	2.5
114 dB / 1000 Hz	0.02	-	0.40	2.5

**Note :**

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

### End of Calibration